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BANK REGULATION, COMPETITION AND FRAGILITY

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HELSINKI SCHOOL OF ECONOMICS
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ABSTRACT
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BANK REGULATION, COMPETITION AND FRAGILITY

PURPOSE OF THE STUDY

The objective of this thesis is to investigate, how the national banking regulatory framework affect the fragility of the domestic banking sector. This study concentrates on that aspect of the regulatory environment that governs and limits the competitive climate of the banking sector and individual banks' risk-taking abilities and incentives. The thesis examines the impact of three different banking regulatory variables, which are: 1) *Activity Restriction*, which restricts the ability of commercial banks to engage in securities, insurance and real estate activities 2) *Foreign Bank Discrimination,* which measures how much foreign banks are discriminated by imposing excessive regulatory entry and operational restrictions 3) *Entry Requirements,* which measures the amount of regulatory requirements for new banks wishing to enter the market. The level of non-performing loans to total loans is used as a proxy for banking sector distress, with more non-performing loans indicating more fragility. The volatility of the return on domestic banking sector stock index is also used as a measure for banking industry vulnerability in robustness check.

DATA

The cross-country data of the three different bank regulation variables for different countries are obtained from the surveys conducted by Barth, Caprio and Levine in 2001, 2003 and 2006 and from the database constructed by Barth, Marchetti, Nolle and Sawangngoenyuang (2007). The time-series data for the level of non-performing loans are obtained from the Global Financial Stability Reports published by the IMF, covering the period of 1998 – 2007 for 80 countries. The data on the volatility of the return on domestic banking sector stock index is gathered from Datastream.

RESULTS

The findings of this thesis clearly shows that excessive regulations limiting the ability of foreign banks to enter and operate in the domestic market create higher levels of non-performing loans and thus more fragile banking sectors. More entry and operational barriers for foreign banks limit competition in the banking sector, produce inefficiently functioning banks and hinders the adoption of modern banking skills and risk management procedures, all of which increases the probability of banking distress. The effect of regulations discriminating foreign banks is especially distinct for high income countries. Furthermore, regulations limiting the ability of commercial banks to engage in different sorts of activities and regulations imposing excessive entry requirements for new banks, do not have a significant impact on banking sector fragility. The findings of this thesis show, that the significant relationship uncovered by previous studies is mainly due to sample choice, and is not robust when the regression specifications are modified and different samples are used.

KEYWORDS

Bank regulations, competition in banking, bank crisis, bank distress

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PANKKIEN LAINSÄÄDÄNTÖ, KILPAILU JA EPÄVAKAUS

TUTKIMUKSEN TARKOITUS

Tämän tutkielman tarkoituksena on tutkia miten kansalliset pankkilainsäädännöt vaikuttavat kotimaisen pankkisektorin tasapainoon. Tämä tutkimus keskittyy niihin lainsäädäntöihin, jotka ohjaavat pankkisektorin kilpailua ja yksittäisten pankkien riskinotto kykyä ja halua. Tutkielma tutkii kolmea erilaista pankkilainsäädäntö muuttujia, jotka ovat: 1) *Toiminta rajoitukset,* mikä rajoittaa liikepankkien kykyä toimia arvopaperimarkkinoilla, olla vakuutustoiminnassa mukana tai harjoittaa kiinteistö sijoitusta 2) *Ulkomaalaisten pankkien syrjintä,* mikä mittaa kuinka paljon ulkomaalaisia pankkeja syrjintää pystyttämällä kohtuuttomia lainsäädännöllisiä sisäänpääsy ja toiminta rajoitteita 3) *Sisääntulo vaatimukset,* mikä mittaa niiden lainsäädännöllisten vaatimusten määrää, jotka vaaditaan uusilta pankeilta tulleessaan markkinoille. Pankkimarkkinan epävakauden mittarina käytetään roskalainojen määrä suhteessa kaikkiin lainoihin, mitä enemmän roskalainoja sitä epävakaammat ovat pankkimarkkinat. Pankkisektorin osakeindeksin tuoton volatiliteettiä käytetään myöskin epävakauden mittarina varmistuksena.

AINEISTO

Maakohtaiset tiedot kolmesta pankkilainsäädäntö muuttujista ovat peräisin selvityksestä, jonka ovat tehneet Barth, Caprio and Levine vuosina 2001, 2003 ja 2006 ja myöskin tietokannasta, jonka Barth, Marchetti, Nolle and Sawangngoenyuang (2007) ovat rakentaneet. Aikasarja aineisto roskalainojen määrästä ovat peräisin Global Financial Stability Reportista, jonka julkaisee IMF. Aikasarja kattaa ajanjakson 1998 – 2007 ja sisältää 80 maata. Tiedot pankkisektorin osakeindeksin tuoton volatiliteetistä ovat peräisin Datastreamista.

TULOKSET

Tämän tutkielman tulokset osoittavat selvästi, että liialliset lainsäädännöt, jotka estävät ulkomaalaisten pankkien toimintaa kotimaisilla pankkimarkkinoilla aiheuttavat selvästi enemmän roskalainoja ja täten epävakaampia pankkisektoreita. Liialliset esteet ulkomaalaisille pankeille rajoittavat kilpailua ja estävät uusien teknologioiden omaksumisen. Tämä tulos on erityisen vahvasti nähtävissä korkean tulon maissa. Lisäksi, lainsäädännöt, jotka rajoittavat liikepankkien liiketoimintamahdollisuuksia ja liialliset pääsyvaatimukset uusille pankeille eivät vaikuta pankkisektori epävakauteen. Tämän tutkielman tulokset näyttävät, että se merkittävä yhteys, jonka aikaisemmat tutkimukset ovat löytäneet, johtuu pääasiassa aineiston valinnasta ja tulos ei ole vahva, kun regressio spesifikaatiota tai aineistoa muokataan.

AVAINSANAT

Pankkilainsäädäntö, pankkien välinen kilpailu, pankkikriisi, pankkien ahdinko

Table of contents

List of tables

List of figures

List of appendices

1. Introduction

1.1 Background and motivation

Banks have a vital contribution to the social welfare and the development of the economy. Their mission is to channel abundant capital to that sector of the economy where it is utilised most efficiently; they provide the financial resources needed for companies and consumers to undertake their businesses. Banks enable credit channelling, risk sharing, liquidity, information sharing and the exchanging of financial assets. The vital importance of a well-functioning banking industry on economic growth has been recognized in the theoretical and empirical literature[1].

Banks, however, have been considered to be extremely prone to distress due to many reasons. First, their liabilities consist mainly of short-term deposits and their assets mainly of long-term illiquid loans. This qualitative and quantitative difference between inputs and outputs and the mismatch of assets' and liabilities' maturities leave banks especially vulnerable to instability. Second, banks also tend to be extremely leveraged and their debtors are usually small and widely dispersed. The debt holders do not possess the resources needed to closely monitor the actions taken by the bank, which can cause serious agency problems in the banking industry. The owners of the bank might be tempted to engage in highly risky projects, where the potential profit mainly benefits the owners while the possible costs will be endured solely by the debtors. This incentive to engage in risky behaviour could jeopardize the stability of the whole industry. The agency problem also plagues the asset side of the bank's portfolio, between the bank and its loan applicants. In addition, information asymmetry is an especially pronounced feature of the banking industry, which creates additional sources of instability. On the liability side, depositors lack the information on the solvency of their bank. Furthermore, depositors are confronted with a fractional reserve system, where only a small amount of liquid reserve is backed to meet deposit withdrawals. Insolvency can happen when a large amount of withdrawals happen due to the release of some adverse information concerning the bank's financial standing. This kind of bank run situation can happen even in the absence of any bad information. If depositors panic, they

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[1] For a review of the literature see Levine (1997)

may try to withdraw their funds out of fear that other depositors will do so first, thus forcing an otherwise sound bank into bankruptcy[2].

Crisis in the banking industry is not only devastating for the banking sector itself, but also for the economy as a whole. Because banks hold financial assets of consumers and producers, instability in the banking sector can have serious consequences for the growth of the national economy. Hoggarth, Reis and Saporta (2001), for example, have estimated that the direct fiscal costs of banking crisis resolutions can even amount to 20% of the national GDP. In addition, banks are connected to each other through a series of networks through interlocking claims. Thus, a failure in one bank can spread to the whole sector having serious repercussions for the whole industry. A fragile banking system is more prone to the occurrence of a large-scale systematic banking crisis when, for example, some external macroeconomic shock occurs. A severe banking crisis will not only cause large fiscal costs for the crisis years, but could also hinder the economic growth of the country and the functioning of its institutions for many years to come. Therefore, prevention of banking sector distress and the strengthening of the domestic banking industry is often one of the main objectives of the national banking supervisors and regulators.

Over the past twenty years, the world has witnessed several instances of severe banking crises in dozens of countries. This is a huge increase in the number of both crisis incidents and countries experiencing a crisis as compared to the period prior to the 1980s. A study conducted by Bordo, Eichengreen, Klingebiel and Martinez-Peria (2001) finds only one systematic banking crisis incident during the two decades following year 1945. In contrast, Caprio and Klingebiel (2003) report 117 systematic banking crises occurring in over 90 countries since the late 1970s. Based on the database constructed by Caprio and Klingebiel, Figure 1 plots the number of systematic banking crisis in different years during the period of 1976 – 2002. Figure 1 indicates that systematic banking crises have become more frequent since the 1970s, reaching a peak during the latter part of the 1990s. The disturbingly large number of banking crises in the 1990s can be mainly attributed to the unsuccessful banking market reforms of many of the former socialist countries after and the large-scale financial distress in Southeast Asia during the latter part of the decade. Even though Figure 1 shows that the number of systematic banking crises has decreased significantly since the early part of

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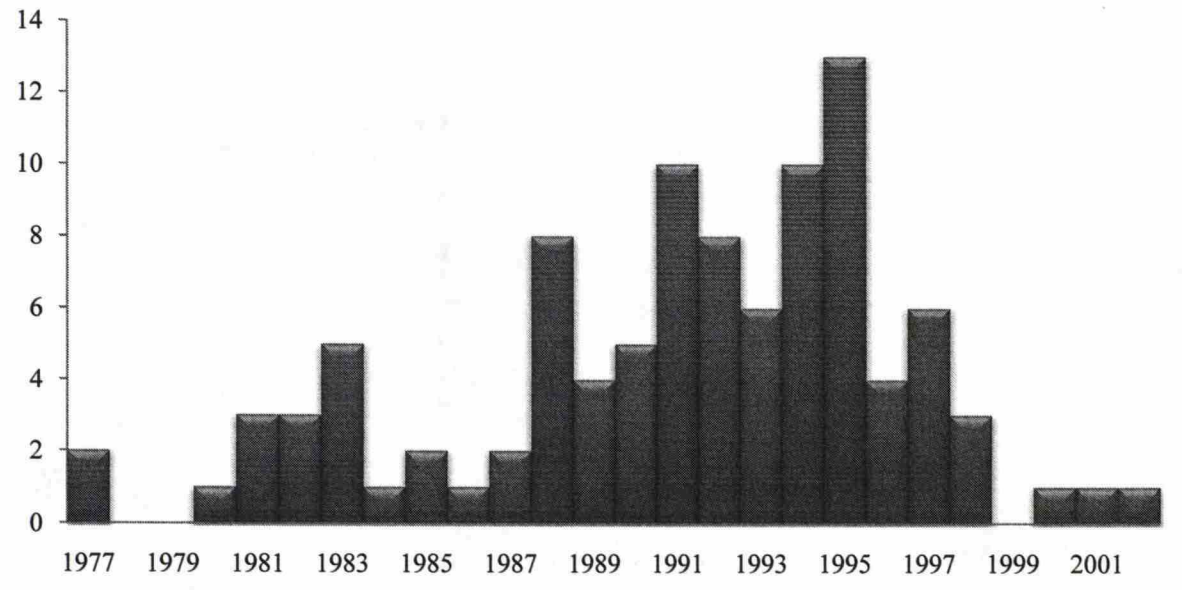
[2] Diamond and Dybvig (1983) have modelled this kind of bank run situation.

the 21th century, the recent mortgage crisis in the United States and the resulting world-wide credit crunch indicates that banking crises are still a serious problem in today's world, plaguing both developing and developed countries alike and with serious repercussions for the world economy and aggravating economic downturns.

Figure 1: The number of systematic banking crisis during the period 1976 - 2003

The figure plots the number of systematic banking crises in different years during the period of 1976 – 2002. The data is obtained from the database constructed by Caprio and Klingebiel (2003) with 102 crises observations in over 80 countries. The authors define that a banking crisis is occurring in a particular country when much or all of the country's bank capital is exhausted. Because it is difficult to indentify the timeframe, and especially the end, of a banking crisis, the vertical axis depicts the number of banking crisis that starts at a particular year. It should be noted, that the majority of crises do continue after its initial year.



The serious banking crises in the last few decades have startled many national authorities, in both developing and developed countries, of the need to enhance and upgrade their banking regulations and supervision to improve crisis prevention and management. However, although many national authorities agree that their regulatory framework needs to be upgraded in order to reduce banking system fragility and excessive risk-taking, there is still disagreement on what kind of changes are needed. The disagreement can be roughly characterized as a twofold debate: Firstly, what aspects of the regulatory environment are the most vital in decreasing banking sector distress. Secondly, should these particular banking regulations be more stringent or unrestrictive in order to enhance stability. Even though there have been numerous discussions, both nationally and internationally, on what kinds of regulations are beneficial

for the financial system, there have been relatively few empirical studies actually investigating the matter.

1.2 Research problem and objectives

The studies by Claessens and Laeven (2004) and Bikker, Spierdijk and Finnie (2007) show that banking regulations are the key determinants of the contestability of the banking sector. National authorities often impose strict regulations limiting bank competition and risk-taking incentives in the hopes of creating more stability in the industry. For example, Keeley (1990) argues that increased competition will lead to greater instability in banking sectors by increasing banks' risk taking incentives and aggravating the moral hazard issues. However, there are also those who favour less stringent regulatory restrictions and assert that more competition will actually increase the stability of the banking sector. Boyd and De Nicoló (2005), for example, show that less competition creates instability in the banking sector by exacerbating the moral hazard of the companies who borrow from the banks. Some also argue that promoting competition in the banking sector forces banks to enhance their operations and risk handling and thus having a beneficial effect on the well-being of the industry. Furthermore, a competitive banking sector advances the development of the economy's non-financial sector, as documented by Claessens and Laeven (2005), which also has a stabilizing effect on the financial sector through better loan repayments. Furthermore, government authorities might use strict regulations to further their own political gains with no corresponding improvement in the market performance (Djankov, La Porta, Lopez-De-Silanes and Shleifer, 2002).

The objective of this thesis is to investigate, how the national banking regulatory framework affect the fragility of the domestic banking sector. This study concentrates on that aspect of the regulatory environment that governs and limits the competitive climate of the banking sector and individual banks' risk-taking abilities and incentives. My thesis examines three different banking regulatory variables and their effects on the fragility of the banking sector. These regulatory variables govern different aspects of the operational environment of banks and each of these somehow limits competition in the banking sector. The three banking variables are: 1) *Activity Restriction*, which restricts the ability of commercial banks to engage in securities, insurance and real estate activities 2) *Foreign Bank Discrimination,* which

measures how much foreign banks are discriminated by imposing additional regulatory entry and operations requirements and restrictions 3) *Entry Requirements,* which measures the amount of regulatory requirements set up for new banks wishing to enter the market.

The level of non-performing loans to total loans (NPLs) is used as a proxy for banking sector distress, with more non-performing loans indicating more fragility. The occurrence of a systematic banking crisis can happen for many reasons, from severe business-cycle downturns to excessive lending booms, and banking sectors with stronger balance sheets, hence less non-performing loans, are at a better position to absorb these shocks. Because the level of NPLs measures the quality of the banks' balance sheets and the solvency of both the banks and its borrowers, it can be regarded as a continuous measure for banking sector fragility. I also use the volatility of the return on the banking sector stock index as an alternative measure for bank fragility in the robustness check section. The variables and the intuition for them are elaborated further in the latter sections.

1.3 The main contributions of the thesis

The previous studies investigating bank regulations' effect on banking sector fragility and on the occurrence of banking crises, for example Barth, Caprio and Levine (2001) and Schaeck, Čihák and Wolfe (2006), have used the values of the bank regulations at the end of their sample period. Countries that have experienced a banking crisis tend to implement drastic changes in their regulatory framework. Thus, the results of the previous studies is plagued by serious causality issues, namely whether bank regulations affect the occurrence of a crisis or is the relationship the other way around. The first main contribution of this study is that I have the possibility to investigate the relationship between bank regulations and fragility using the bank regulation values from the beginning, the middle and the end of the sample period. This way the causality issues, elaborated more thoroughly in the latter sections, can be partly overcome. Furthermore, I divide the sample period in order to examine whether regulatory effects are consistent in different periods of time and also exclude countries that have imposed large changes in their regulatory environment to see whether the results are robust.

Another important contribution of this study is that it is the first study, to the best of my knowledge, that uses data of the actual national regulations limiting the entry and the

operations of foreign banks. Previous studies that have investigated the effect of foreign bank discrimination, for example Barth, Caprio and Levine (2004) and Beck, Demirgüc-Kunt and Levine (2006), have used the percentage of foreign ownership of bank assets or the fraction of foreign bank entry applications denied, as a proxy for the regulatory disadvantage. The fraction of entry application denied is an incomplete measure, because countries that discriminate foreign banks might receive fewer applications to begin with. Furthermore, the ownership of bank assets by foreigners does not fully represent the actual regulatory practices restricting the abilities of foreign banks to enter and operate in the market. This thesis equipped with the data on the actual regulatory practices that discriminate foreign banks, which is obtained from the database by Barth, Marchetti, Nolle and Sawangngoenyuang (2007), truly adds to our knowledge about the effects of restrictive regulations on banking sector stability.

The third contribution of this study comes in the form of extensive data on the level of non-performing loans obtained from the Global Financial Stability Reports (GFSR) published by the IMF. The study by Barth, Caprio and Levine (2004) tries to overcome the causality issues mentioned above by using data on the level of non-performing loans in years after the observations of the banking regulation variables. However, they only have one year observations of the NPLs for different countries. Due to their limited dataset, Barth et al. are unable to perform extensive experiments with different samples, for example excluding countries from the sample that have experienced banking crises. Furthermore, their regression models do not include a wide array of control variables to capture other significant factors at work. The dataset in my thesis has annual information on the level of NPLs for 80 countries covering the period of 1998 – 2007. The data includes both developing and developed countries and countries that have experienced a crisis and those that have not. Due to the extensive dataset I can perform regressions where the crisis countries are excluded and can run regressions separately for the high and low income countries. Furthermore, the regressions are performed when a host of institutional and macroeconomic factors are controlled for that might affect the level of NPLs. These coupled with the robustness checks using an alternative measure for banking sector fragility, the volatility of the return on the banking sector stock index, gives further insight into the relationship between banking regulations and fragility.

1.4 Key results

The first main finding of this thesis is that excessive regulations limiting the ability of foreign banks to enter and operate in the domestic market create higher levels of non-performing loans and thus more fragile banking sectors. More entry and operational barriers for foreign banks limit competition in the banking sector, produce inefficiently functioning banks and hinder the adoption of modern banking skills and risk management procedures, all of which increases the probability of banking distress. The effect of regulations discriminating foreign banks is especially distinct for high income countries; the incremental effect of discriminatory regulations is more pronounced in a country with otherwise well-functioning institutions. The positive relationship uncovered remains robust when a host of macroeconomic and institutional factors are controlled for, when the sample period is divided into sub-samples and when countries that have experienced banking crises in the past or have implemented large changes in their regulatory framework are excluded.

The second central finding of my thesis is that regulations limiting the ability of commercial banks to engage in different sorts of activities and regulations imposing excessive entry requirements for new banks, do not have a significant impact on banking sector fragility. The findings of the thesis show, that the significant relationship uncovered by previous studies is mainly due to sample choice, and is not robust when the regression specifications are modified. Regulations restricting bank activities do have a considerable effect on the level of NPLs in the main specifications, but the relationship breaks down when the sample period is divided and when countries that have realized significant changes in their regulatory environment are excluded from the sample. Based on the findings of previous studies, many academics have advocated for less stringent regulations limiting bank activities and have welcomed the repeal of the Glass-Steagall Act[3] in the United States. However, my thesis shows that the relationship is not that straightforward and more studies are warranted.

1.5 Structure of the study

The remainder of this thesis is structured as follows. Section 2 presents a review of the most relevant theoretical and empirical studies related to this thesis. Section 3 discusses and

[3] The regulations separated commercial banks from investment banking activities. It was dismantled in 1999.

motivates the hypotheses. Section 4 describes the data and its construction and collection process. Section 5 examines the causality issue between banking regulations and crises. Section 6 presents the methodology used in the study. Section 7 provides the empirical results of the study. In Section 8 robustness checks are performed. Finally, Section 9 concludes.

2. Literature review

This section reviews the most relevant theoretical and empirical research for my thesis. The first part of this section presents the theoretical and empirical literature on the factors that determine the competitive climate of the banking sector. In the second part, the theoretical discussions on the relationship between competition and stability in banking are reviewed. The third subsection presents empirical findings uncovering the correlation between banking competition and stability.

2.1 Determinants of bank competition

Before presenting the theoretical background and the empirical findings uncovering the relationship between banking competition and stability, I review the literature on the determinants of competition in the banking sector. The first part of this subsection presents the theoretical discussion on what factors should determine the competitiveness of the banking industry. In the second part, I review the empirical findings on what factors have a significant effect on the competitive climate.

2.1.1 Theoretical literature on the determinants of bank competition

Traditionally, the degree of competitiveness in the banking industry has been characterized by the number of banks operating in the sector. This approach is derived from the classic Industrial Organization literature called the structure-conduct-performance (SCP) view that asserts that a company's market power is related to the structure of the market. In a more concentrated market with fewer competitors, the few big players can exert more market power and engage in a more monopolistic pricing behaviour. According to the SCP hypotheses, all banks respond similarly to an increase in market concentration, by strengthening their

collusive behaviour. As a result, they all benefit equally from such a change. Thus, the more concentrated the banking industry is the more probable it is that the few large incumbent banks will utilise their market power and engage in collusive and non-competitive behaviour.

There are a number of difficulties with the SCP view on the negative relationship between the intensity of competition and market concentration in the banking sector. First, the efficient structure hypotheses states that a more concentrated banking industry might mean that there are just more efficient banks operating in the market, rather than that these banks have complete market power. Banks that are more efficient tend to have higher profits and lower costs, which mean that they are at a better position to gain market share and squeeze the less competitive banks out of the market, thus making the industry more concentrated. According to this theory, bank efficiency is the driving force behind market concentration; high concentration endogenously reflects the market share gains of efficient banks, not that the market is uncompetitive. The incumbent efficient banks can still act competitively in order to drive out rest of the competitors.

The theoretical model developed by Dell'Ariccia (2001) shows that a concentrated banking market can actually be very competitive due to the serious information asymmetry between lenders and borrowers in the banking industry. The author argues that in the process of lending and establishing lending relationships, banks gather some proprietary information about the borrowers' creditworthiness, which helps the banks to discriminate between profitable and unprofitable borrowers. The more proprietary information the bank has, the greater advantage it has over its competitors. Therefore, the larger market shares the banks obtain the more valuable information capital it accumulates. Furthermore, with such information banks acquire some degree of monopoly power over their clients and an advantage over their competitors. However, the asymmetric information and the process of learning by lending provide the incumbent banks with an incentive to charge low interest rates to compete for new borrowers and to compete more aggressively for market share. Thus, information asymmetry in the banking sector will create fewer but more aggressively competing banks, and as a result more concentrated markets might be associated with lower interest rates and more intense competition.

The contestability approach also states that competitive outcomes can occur in very concentrated markets, and that collusion can occur even when there are a large number of banks in the market. This theory emphasises that it is the inherent characteristics of the market, such as barriers to exit and entry, which affect the competitive behaviour of banks in the market. The theory argues that instead of the market structure of the banking industry, entry barriers for new banks, regulations restricting banks' activities and other regulatory impediments are the key factors limiting the competitiveness of the industry. Furthermore, the degree of competition the banking industry is facing from other financial institutions and markets, such as capital markets and non-bank financial institutions, could also play a key role in determining the competitiveness of the banking sector. Supporting the contestability view, Besanko and Thakor (1992), for example, develop a theoretical model where the relaxation of entry barriers into banking lowers the equilibrium loan interest rates and increasing the deposit interest rates making the banks more competitive.

Some suggest that the ownership structure of banking market can also have a pronounced effect on the degree of competition. For example, foreign-owned banks may have other advantages over domestically-owned banks in serving multinational customers, access to capital, use of technology and so forth. Thus it is plausible that the large presence of foreign-owned banks and lower barriers to entry and operations for foreign banks could stimulate greater competition in the domestic banking market. Also, there is the possibility that the large presence of state-owned banks might have a substantial effect on the competitive climate of the banking sector. State-owned banks generally have objectives other than profit or maximization, for example the development of specific industries or regions, which could result in more competition in these areas and less competition in other services. Also, many of these financial institutions usually operate with implicit or explicit government subsidies and guarantees, which might reduce market discipline and distort the competition in the market.

2.1.2 Empirical findings on the determinants of bank competition

There have been numerous empirical studies examining the factors that determine the competitive climate in the banking market[4]. One of the first studies examining these relationships was done by Berger and Hannan (1989), who investigate the relationship

[4] For a survey of the literature see Berger, Demirgüc-Kunt, Levine and Haubrich (2004)

between bank concentration and profitability using the data for U.S. banks covering the period of 1983 – 1985. The authors find that banks operating in the most concentrated local markets paid lower deposit rates, hence it could be argued that bank concentration is associated with less severe competition. Berger and Hannan note, however, that the price-concentration results found do not rule out the possibility that the efficient structure hypothesis also plays a role in the profit-concentration relationship.

Demirgüc-Kunt, Laeven and Levine (2004) examine the impact of bank regulations, market structure and national institutions on banks' net interest margins and overhead costs using data on over 1400 banks across 72 countries, with higher net interest margins and overhead costs meaning less severe competition and inefficient banks. The authors show that more barriers to entry for new banks, restrictions on permissible bank activities and regulations that inhibit the freedom of bankers to conduct their business boost bank net interest margins. Demirgüc-Kunt et al. point out, however, that after when the development of the broader institutional quality is controlled for, bank regulations do not provide additional explanatory power. Still, the authors do not interpret the results as suggesting that bank regulations are unimportant, but that the regulations reflect the quality of the wider national institutions. The results provided by Demirgüc-Kunt et al. also show that bank concentration has a significantly positive effect on bank net interest margin. However, when regulatory restrictions, macro-economic stability and the overall institutional climate are controlled for, the relationship breaks down. Based on their results, the authors argue that using national bank concentration as a measure for the competitive climate in the banking industry is not necessarily feasible when other characteristics of the country are taken into account.

Claessens, Demirgüc-Kunt and Huizinga (2001) investigate the effect of foreign bank presence on the competitiveness of the domestic banking sector. The authors examine how net interest margins, overhead costs, taxes paid and profitability differ between foreign and domestic banks using a dataset that covers 80 countries during the years 1988-1995, with about 7900 individual commercial bank observations. Claessens et al. find that foreign banks tend to have higher interest margins, profitability and tax payments than domestic banks in developing countries, while the opposite is true in developed countries. The findings of the authors provide empirical evidence that for most countries a larger share of foreign-owned banks is associated with a reduction in the profitability and margins of domestically owned

banks, thus forcing domestic banks to act more efficiently and making the national banking markets more competitive. In addition, Levine (2004) discover that higher restrictions of foreign bank entry, measured by the fraction of foreign bank entry applications denied, boost bank net interest margins. In addition, the author finds that restricting domestic bank entry does not help explain bank margins and that the degree of foreign bank ownership is also insignificant. Based on his findings, Levine argues that regulatory impediments to foreign bank entry are pivotal in determining the degree of competition in the domestic banking sector.

The major setback with the findings of the above mentioned papers is that the dependent variable used, namely the bank net interest margin or the deposit rate paid, might not be a fully valid proxy for competitiveness of the banking sector. Some researchers have tried to overcome this problem my using an empirically calculated variable that directly measures the competitiveness of the banking industry. Claessens and Laeven (2004) try to overcome this issue by using a non-structural approach to investigate the impact of market structure and other factors on the intensity of banking competition. The authors use the measurement technique developed by Panzar and Rosse (1987) to calculate an index called the H-statistics[5], which measures the competitiveness of the banking industry, with higher values representing more competition. In their paper, Claessens and Laeven find that being open to the entry of new banks into the market has the most significant effect on competition. The authors also discover that greater foreign bank presence, fewer activity restrictions in the banking sector and less entry restrictions on commercial banks can make for more competitive banking systems. Contrary to the view maintained by the SCP - approach, the authors find some evidence that more concentrated banking systems tend to be more competitive. The authors also discover that the competitiveness of the banking sector is negatively related to the number of banks operating in the country, although the results are never significant.

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[5] This technique uses firm-specific data and focuses on the extent to which a change in factor input prices is reflected in the revenues earned by a specific bank. The model produces the H-statistic, which ranges between 0 and 1, and measures the degree of competitiveness of the banking industry. If the H-statistic is less than 0 it is a monopoly situation, less than 1 being monopolistic competition and 1 is perfect competition. For a review of the model and its strengths and weaknesses see Shaffer (2004).

Similarly, Bikker, Spierdijk and Finnie (2007) also investigate the impact of several country and banking system characteristics on the value of the H-statistics of the banking market. In accordance with the contestability literature, the authors find that the fewer restrictions on foreign investments create more competitive banking sectors. In addition, the authors find that strict regulations restricting bank activity activities make large banks less competitive, a country's institutional environment is a major determinant of banking competition and that competition is substantially lower in countries with a socialist legal history, for instance in Eastern Europe. Finally, contrary to the findings of Claessens and Laeven (2004), Bikker et al. do not find that bank concentration has any significant effect on banking sector competitiveness, provided that other relevant explanatory variables are included in the model specification. Interestingly, the authors find evidence that the competitiveness of the banking sector is negatively related to the number of banks in the country, although the results are never significant.

2.1.3 Summary

Previously, academics believed that the market structure is the major determinant of the competitive climate in the banking sector. This view follows the structure-performance-conduct (SPC) approach, which argues that in a more concentrated market with fewer competitors, the few big players can exert their market power and engage in a more monopolistic pricing behaviour distorting competition. However, there are numerous theories challenging the negative relationship between competition and concentration argued by the SPC-approach. Lately, the contestability approach is the more widely held theory among academics, which states that instead of market structure it is the inherent regulatory characteristics of the banking sector, such as barriers to entry and other regulatory impediments limiting competition, which determines the competitive climate. In line with this view, a majority of the empirical studies have found that strict regulations restricting banks' abilities to engage in different forms of activities, excessive regulatory barriers to entry, weak institutional environment, low foreign bank presence and high barriers to entry for foreign banks are the key factors distort and decrease the competitive climate of the banking sector. Market structure variables, on the other hand, were not found to have statistically significant explanatory power on the level of bank competitiveness.

2.2 Theoretical background on competition and stability

There are two lines of views on how the competitive climate of the banking sector affects the stability of the whole industry. The view which asserts that more competition among banks creates a larger degree of fragility and instability in the banking sector is called the competition-fragility approach. The proponents of the opposing view, those who argue that more competition actually stabilises the banking sector, are called the proponents of the competition-stability view. Next, I present the arguments and the reasoning for both of these views. It should be noted, that some of the studies presented below are implicitly making the assumption that the market structure, i.e. bank concentration and the number of banks, is strictly correlated with the level of competition in the banking sector. As Section 2.1 demonstrated, this assumption is not necessarily valid, thus caution is warranted when the arguments are interpreted.

2.2.1 Competition – Fragility

Borrowers' failure to repay loans is one of the most likely sources of banking problems and this probability depends in large part on the bank's risk-taking behaviour. The classic theory developed by Jensen and Meckling (1976) maintains that highly leveraged firms have a strong incentive to take on excess risk at the detriment of the debt holders. By granting loans with a high expected return, but also entailing high risks, the possible gains fall mainly to the shareholders' while the downside is mostly suffered by the debtors. This agency problem is particularly strong for banks due to their highly leveraged financial structure and widely dispersed debt-holders, who are usually highly uninformed of the banks' activities and risks.

The proponents of the competition-fragility view argue that banks with more market power, hence higher profits, are less prone to financial fragility. Large banks facing less severe competition have been viewed as having more incentives to reduce their risk-taking behaviour and to improve their asset quality. Franchise value, or alternatively charter value, is the profit that is accumulated to banks' owners from future operations and therefore represents the opportunity costs of going bankrupt. The higher the franchise value is, the less willing the bank is to take on risky bets, since it has more to lose if the gamble goes wrong. Banks facing a less severe competition have higher rents and thus higher franchise values, which deters

risk-taking behaviour. Increased competition decreases franchise value for all incumbent banks, which in turn increases risk-taking behaviour making the whole banking industry more fragile and prone to crisis. In accordance with the franchise value theory, Keeley (1990) argues that the high number of bank failures in the United States during the 1980s was mainly due to increased competition caused by the deregulation of the banking industry.

Besanko and Thakor (1993) also argue that increased interbank competition decreases banks' franchise value and increases the riskiness of the banks' portfolios. The authors show in their theoretical model that when facing a high level of competition, either from other banks as or from the capital markets as well, the value of the bank-customer relationship for the banks decreases and also the value of proprietary information gained from this relationship. This accentuates the attractiveness of risky pursuits for the bank, thus increasing the likelihood of bank failures.

Hellman, Murdock and Stiglitz (2000) give further support for the franchise value theory by arguing that financial liberalization, which usually intensifies competition in the banking sector, erodes banks' franchise value and deepens the moral hazard problem. The authors argue that financial market liberalization increases the likelihood of banking crises in two ways. First, market liberalization reduces barriers to entry and eliminates deposit rate ceilings and thus increasing competition. Hellman et al. show in their dynamic model that if markets are sufficiently competitive, banks fill find it desirable to gamble and take on excessive risks threatening the stability of the industry. Second, financial liberalization also reduces activity restrictions imposed on banks. A range of new activities that had previously been forbidden from banks, such as many derivative trades and foreign currency transactions, are opened up to banks and this way creates many new ways for banks to engage in risky gambling activities.

High levels of bank competition can also worsen the bank's portfolio by affecting through the channels of loan screening. A better loan screening enhances the quality of the bank's assets which improves its financial standing, and banks with stronger market power might have more incentives to closely monitor the loan applicants. Cordella and Yeyati (2002) develop a theoretical framework where an increase in competition leads to decrease in investments in the monitoring of loan applicants worsening the bank's loan portfolio. When the banks take

on more unsound loans on their balance sheets, banking distress becomes more probable. But the authors also show that the problem of inadequate monitoring can be mitigated by both public disclosure of the riskiness of the bank's portfolio and risk-based deposit insurance.

Even if intensified competition would not affect banks' monitoring incentives, an increase in loan market competition could lead to the deterioration of the bank's asset quality due to winner's curse arising from the large degrees of asymmetric information. Shaffer (1998) argues that this winner's curse results from the ability of rejected loan applicants to apply for loans from other banks in the market. The least risky loan applications will tend to be approved by the first bank approached. If credit screening is imperfectly correlated across banks and if there is an information barrier between banks so that the lender is unaware of whether an applicant has been rejected by other banks, riskier applicants can shop around until some bank is willing to extend a loan. The more banks are in the market, the greater is the probability that unsound applicant will be granted a loan. The average creditworthiness of the pool of applicants is then systematically degraded as a function of the number of banks[6].

2.2.2 Competition – Stability

The proponents of the competition-stability view argue that increased competition in the banking industry might actually lead to a more stable market. Boyd and De Nicoló (2005), for example, have challenged the franchise value theory by arguing that banks actually become more risky as their markets becomes less competitive. In their model, the bank portfolio problem is transformed into a contracting problem with moral hazard in which the borrowers are assumed to entirely determine project risk, conditional on the loan rate set by banks. As competition declines banks use increasing market power to raise the loan rates, and when confronted with increased funding costs borrowers optimally choose riskier projects with higher payoffs. This effect is further reinforced by moral hazard on the part of the borrowers who, confronted with higher interest costs, optimally increase their own risk profile when bankruptcy costs decrease. The authors argue that the franchise value view focuses solely on the deposit side. However, the authors argue that apart from the deposit channel, there is also a loan market channel that could eliminate the advantageous effects that reduced competition

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[6] It should be noted, that the number of banks in the market is not necessarily a valid proxy for the competitive climate of the banking sector as demonstrated in Section 2.1.

in the deposit market has on bank stability. Low levels of competition among banks can actually create more fragile banking sectors through the loan market channel.

Caminal and Matutes (2002) have also questioned the negative relationship between competition and stability argued by the advocates of the competition-fragility view. The authors argue that banks can never fully control a loan applicant's allocation of the funds and its choice of the project to be undertaken. To mitigate this agency problem, banks have two ways to induce appropriate projects of its choice: either by rationing credit or by more carefully monitoring the borrower. Banks facing less severe competition and more market power are at a better position to monitor borrowers and more willing to invest in customer relationships[7], thus they exert less credit rationing and have larger loans on their asset side. In the theoretical framework modelled by Caminal and Matutes, where all projects are subject to a multiplicative aggregate shock and the riskiness of a loan increase with its size, more competition can actually have a more stabilizing effect on the banking industry by reducing the average size of bank credits.

Another argument in favour for the competition-stability view is that in a less contested market, where there are fewer banks, policymakers are more concerned in the failure of an individual bank. Based on these assumptions, banks in more concentrated systems will tend to receive larger government subsidies through implicit too-big-to-fail policies that intensify risk-taking incentives and hence increase banking system fragility. Mishkin (1999) argues that when depositors and creditors of large financial institutions know that the institutions are likely to be protected by the national government if they fail, the debt-holders have less incentive to monitor the banks' risk-taking behaviour, which encourages banks' risk-seeking incentives even further. Once again, the number of banks is assumed to represent the degree of competition.

The proponents of competition-stability view also argue that increased competition in the banking sector makes banks more efficient and resilient to vulnerability by forcing them to enhance their operations and to clean up their balance sheets. To survive in the competitive industry, banks have to screen loan applicants better; if there are more non-performing loans on their balance sheets and the profits are not regained in the long-run, they could be easily

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[7] See Petersen and Rajan (1995)

squeezed out of the market. More competition increases transparency which creates financial institutions that are better equipped in shielding a shock in the banking sector. Furthermore, if the domestic banking sectors are open to foreign entry and presence forcing the domestic banks to face competition from foreign banks, the domestic sector could benefit from the stabilizing effects of the skills and technology in risk management that foreign banks bring.

Claessens and Laeven (2005) discover that more competitive banking sectors allow faster growth and development in the domestic non-financial sectors. A well-functioning non-financial sector contributes to the stability of the financial system by allowing the borrowers' to be at a better position to repay their loans, which enhances the quality of the banks' balance sheets. On the other hand, Petersen and Rajan (1995) documents that in a less contested market, banks are actually more willing to invest in relationship building thus more likely to lend credit that foster growth. However, the study by Petersen and Rajan focuses on the growth of small credit-constrained companies, whereas Claessens and Laeven concentrate on the growth of whole industries.

2.2.3 Summary

All in all, the theoretical debate between the proponents of the competition-fragility view and of the competition-stability view still goes on. On one hand, more competition decreases banks' franchise value which creates more incentives to take on additional risks. In addition, increased competition reduces the banks' incentive to monitor loan applicants and increases the winner's curse, all of which worsen the banks' balance sheets. On the other hand, less competition leads to higher rents demanded by the banks and therefore creating more incentives for the borrowers to take on additional risk. Furthermore, reduced competition can produce severe moral hazard problems through too-big-to-fail policies, create less efficiently operating banks with out-of-date banking technology inadequate risk-management skills, and also slow the development of the non-financial sector and hindering their ability to repay loans. All of these effects can increase the vulnerability of the banking sector. To summarize, neither of the two theoretical views has a definite advantage over the other. Thus, more clarification on the issue must be searched from the empirical literature.

2.3 Empirical findings on competition and stability

In this subsection I present the empirical studies aimed at investigating the relationship between bank competition and fragility. The studies reviewed here use different variables to measure the competitive climate of the banking sector, from bank concentration, advocated by the SPC-approach, to entry barriers, promoted by the contestability approach. Readers should note that in some of the papers discussed in this subsection, the explanatory variables used as a measure for the degree of competition in the banking industry have are not necessarily a valid proxy, thus some of the results presented should be interpreted with prudence. The empirical studies are divided into three parts according to the nature of the explanatory variables used as a proxy for the competitiveness of the banking sector.

2.3.1 Contestability approach

Many studies have used market characteristics, namely the stringency of different banking regulations, as a measure for the competitive climate in the banking sector. Keeley (1990) presents evidence that the deregulation of state branching restriction in the United States in the late 1980s increased interbank competition, which caused banks to increase their risk taking. First, Keeley found that the easing of regulatory restrictions eroded the banks' market-to-book asset ratio (Tobin's q ratio), which he used as a measure for the banks' market power and franchise value. Next, he regress the capital-to-asset ratios of 85 large US bank holding companies to their Tobin's q ratio. The parameter of Tobin's q in this regression is positive and highly significant, indicating that lower franchise values are associated with reduced capital cushions in banks. In addition, the interest rates on large certificates of deposits (CDs) for 77 large bank holding companies between are regressed on Tobin's q. The coefficient for Tobin's q is negative and significant indicating that reduced market power and franchise value (lower q) is associated with higher risk premiums reflected in the CD rates. Both estimations suggest that the erosion of franchise value leads to an increase in the banks' risk profile causing more fragility. Based on the fact that the easing of bank regulations created more competition and at the same time lowered the franchise value of banks, Keeley deduces that increased competition leads to more instability in the banking sector.

Jayaratne and Strahan (1998), on the other hand, find that deregulation and an increase in bank competition actually increases efficiency and stability using a larger dataset than Keeley. Jayaratne and Strahan investigate the changes in the variables measuring the well-being of banks after the deregulation of state-wide branching in US. In their analysis, the authors present estimates of changes in state-level aggregate measures of profits, operating costs and loan losses following deregulation. They focus on nine state-level data and constructed a balanced panel-data, in order to avoid selection and survivorship problems that would bias tests performed on data from individual banks. Their findings show that bank efficiency and profitability improved sharply once restrictions on intrastate branching were lifted; loan losses decreased by about 50 percent and operating costs decreased 8 percent once state-wide branching were permitted. The authors argue, contrary to Keeley, that deregulation created more efficient banks and contributed to the stability of the whole sector.

Supporting the findings of Jayaratne and Strahan, Barth, Caprio and Levine (2001) find that countries with greater regulatory restrictions on securities activities of commercial banks and on banks' abilities to own nonfinancial firms have a substantially higher probability of suffering a major banking crisis. More specifically, countries with more stringent banking regulations inhibiting the ability of commercial banks to engage in a more diverse set of business activities tend to have more fragile financial systems. In line with their previous study, Barth, Caprio and Levine (2004) using a larger cross-country database with over 100 countries find that tight regulations restricting bank activities are associated with a higher probability of suffering a systematic banking crises. Furthermore, the authors find that more entry requirements for new banks and large government presence in the banking sector all contribute to more fragile banking systems. The findings of Barth et al. suggest that strict regulations limiting bank competition are hazardous for the stability of the industry.

To my best knowledge, there have been no studies investigating how regulatory impediments restricting the ability of foreign banks to enter and operate in the domestic banking market affect the stability of the sector. Though not strictly comparable, there have been studies examining the effects of the actual foreign bank presence in the domestic market. Barth, Caprio and Levine (2004) find that the level of foreign bank presence did not have a significant effect on the country's likelihood of experiencing banking crises. Bongini, Claessens and Ferri (2001) investigate how foreign ownership affects the probability that an

individual experiences financial distress during the periods of banking crisis by examining the crises episodes in the Southeast Asian countries in the 1990s. Their findings show that foreign portfolio ownership decreases the probability of financial distress and that none of the foreign-controlled institutions was closed. Both of the studies underline foreign banks' beneficial effect on banking sector.

2.3.2 Structure-Performance-Conduct approach

This subsection reviews the studies using market structure variables as a proxy for the competitive climate. For example, De Nicolò, Bartholomew, Zaman and Zephirin 2004 find that large banks undertaking in a wide scope of activities exhibited higher levels of risk than smaller and more specialized financial firms. The authors also discover that highly concentrated banking systems exhibited higher levels of systemic banking risk potential than less concentrated systems. The systematic risk of an individual bank is measured by its Z-score[8], with higher values indicating smaller risk. To calculate the risk of an individual bank, De Nicoló et al. use a sample of the largest financial institutions worldwide. The measure used for the systemic risk potential of an individual country's banking sector is the aggregate Z-score (i.e. consolidated accounts) of the largest five banking firms in each country. The findings suggest that non-strict regulations permitting banks to engage in different sorts of activities and less competitive markets caused by high levels of bank concentration increase the systematic risk of the banking sector. However, Laeven and Levine (2006), using a sample database on almost 300 banks across 48 countries, discover that banking sector concentration do not have a significant on the Z – score of individual banks. The authors do find, contrary to De Nicolò et al., that banks operating in countries which do not restrict banks' abilities to engage in different activities actually have lower Z – scores.

Boyd, De Nicolò and Jalal (2006) support findings of the above mentioned paper by using a larger sample of observations. Boyd et al. also used the Z-score as an indicator of a bank's risk of failure. They use the Hirschmann-Herfindahl Index (HHI) as a measure of how concentrated the market power is, i.e. how intensive is the competition in the sector, with

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[8] The Z-score is an empirical measure for risk, defined as $Z=(ROA+EA)/\sigma(ROA)$, where *ROA* is the rate of return on assets, *EA* is the ratio of equity to assets, and σ (*ROA*) is an estimate of the standard deviation of the rate of return on assets. The score increases with the increase in profitability (ROE) and capital cushion (EA) and decreases with the increase in the return volatility (σ), thus a larger value for Z-score implies a smaller risk profile for the financial firm.

larger HHI[9] indicating less severe competition. The authors discover that the probability of an individual bank's failure is positively and significantly related to the size of the HHI-index of the banking sector. The authors used two data sets: a cross-sectional sample of about 2,500 U.S. banks in 2003, and an international panel data set with bank-year observations ranging from 13,000 to 18,000 (2700 banks). Based on their findings, Boyd et al. argue that less contested banking sectors, measured by high bank concentration, have a higher probability of experiencing banking distress.

Beck, Demirgüc-Kunt and Levine (2006) examine the relationship between competitiveness of the banking sector, measured by the concentration ratio, and the occurrence of systematic banking crises in a cross-country setting. The authors' dating and definition of a banking crisis is derived from the database constructed by Caprio and Klingebiel (2003). The data consists of 69 countries with 47 crisis episodes covering almost 20 years. The authors use a logit probability estimation model, in which the dependent variable is a dummy variable that equals to one if the country is going through a systemic crisis and zero if it is not. The bank concentration ratio enters as an explanatory variable, along with a host of macroeconomic and structural control variables. The concentration measure is calculated as the share of assets of the three largest banks in the banking system of each country. Beck et al. find that more concentrated national banking systems are subject to *a lower* probability of experiencing systemic banking crisis, and hence are more stable. The findings hold even when the authors have controlled for a wide array of macroeconomic, regulatory and institutional factors, when using different definitions of banking crises and after examining different subsamples of countries. Beck et al. are, however, cautious in interpreting their findings as suggesting that less competition enhances stability, since they find that other measures of competition have the opposite effect on banking crisis probability. Most importantly, the authors find that more barriers of entry and tighter regulations restricting banks' abilities to engage in different forms of activities create greater likelihood that a country will experience a systematic banking crisis. The authors deduce that bank concentration is an inappropriate measure for the competitive climate, and that strict regulations limiting competition increase banking sector fragility.

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[9] The index is calculated by taking the market share of each bank in the industry, squaring it, and then adding them all up.

2.3.3 Non-structural approach

There has been one study that uses an empirically calculated measure to proxy for the competitiveness of the banking sector. This study has been implemented by Schaeck, Čihák and Wolfe (2006), which uses the Panzar and Rosse (1987) H – statistic[10] as a measure for bank competition. Using the same methodology as applied by Beck, Demirgüc-Kunt and Levine (2006), the dataset consists of 38 countries and 28 systematic crises episodes for the period of 1980 – 2003. Information on the H-statistics for different countries the authors obtain from the study by Claessens and Leaven (2004). Schaeck et al. present evidence that higher H – statistics, hence more competition, is associated with a lower probability of experiencing a systematic banking crises, thus supporting the competition-stability view. The relationship between H – statistics and banking fragility is robust even after controlling for a set of regulatory and institutional variables. Interestingly, the coefficient of bank concentration is insignificant when inserted into the estimation model. Schaeck et al. argue that the findings prove that concentration and competition are distinct from each other and that the competitive behavior of banks is more important in determining the banking system's stability, with more competitive bank behavior resulting in more stable banking sectors.

2.3.4 Summary

Similarly with the theoretical debate, the empirical studies investigating the relationship between banking competition and fragility offer conflicting results. Some of the studies provide evidence in support for the competition-fragility view, and others are in line with the arguments of the competition-stability proponents. The studies differ significantly from each other, not only because of the dataset used, but most importantly because of the differences in the variables used as a measure for the competitive climate of the banking sector. Thus, the studies done in this area are not strictly comparable with each other. However, it is safe to say that the majority of studies using the contestability approach in defining banking sector competition are in support of the competition-stability view; more regulatory barriers limiting banks' abilities to engage in different activities and higher regulatory barriers to entry for new banks result in more fragile and distressed banking sectors.

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[10] This method is elaborated in greater detail in Section 2.1.1.

3. Hypotheses

This section presents the hypotheses of my thesis. The hypotheses are based on the literature reviewed in Section 2. The aim of this thesis is to investigate how different types national banking regulations, which limit the competitive climate and the contestability of the banking sector, affect the fragility and vulnerability of the whole financial system.

Banking regulations govern the environment in which the banks operate and ways in which individual they operate. National regulations are the factors that determine, to a large extent, the shape and the structure of the banking sector. Most importantly, banking regulations have a profound effect on the contestability of the banking market the competitive behaviour of incumbent banks. The studies by Claessens and Laeven (2004) and Bikker, Spierdijk and Finnie (2007), to name just a few, show that differences in the national banking regulations are the key determinants of cross-country differences in the degree of bank competition. Furthermore, there have been a large number of studies stating that competition in the banking sector affects the stability of the whole banking system. For example, Keeley (1990) and Hellman, Murdock and Stiglitz (2000) posit that intense competition will create instability in the banking sector, whereas Caminal and Matutes (2002) and Boyd and De Nicoló (2005) argue that competition results in greater stability.

Therefore, following previous studies, I argue that national banking regulations that limit the competitive climate of the banking sector determine the fragility and the efficient functioning of the whole banking system. Even though there has not been an agreement among academics on whether or not intense bank competition is beneficial for the stability of the banking sector, my central proposition is that strict regulations limiting competition will cause more fragility and vulnerability in the banking sector. This proposition is in line with the majority of empirical studies in this area. There are three types of bank competition regulations and hypotheses studied in this thesis, which I elaborate further in the next three subsections.

3.1 Regulations restricting commercial bank activities

Some national authorities try to reduce banking sector fragility by adopting policies and regulations that limit the number of different activities that commercial banks can engage in.

Most often, these types of regulations impose restrictions on the ability of commercial banks to engage in securities, insurance and real estate activities and also on their abilities to own nonfinancial companies. The proponents of these types of policies argue that there are inherent conflicts of interest when commercial banks are able to engage in different sorts of activities. These activities can create more risk-taking opportunities for banks and also aggravate the already severe moral hazard issues inherent in the banking sector. In addition, regulations restricting bank activities limit the degree of intra-industry competition banks face and therefore increase banks' franchise value and create incentives for banks to behave prudently. Furthermore, an unrestricted environment can produce banks with complicated structure and operations which are extremely difficult to monitor by the supervisors and the market. This can have serious repercussions for the stability of the banking sector as the recent credit crunch as demonstrated.

However, there are also those who favour for fewer restrictions on bank activities. The proponents of this view argue that substantial freedom with respect to the activities of commercial banks creates more diversified and thereby more stable banks. Less stringent regulations restricting bank activities will increase the degree of competition in the banking sector, as demonstrated by Claessens and Laeven (2004), which, according to the proponents of the competition – stability view, reduces banking sector fragility. Furthermore, the possibility to engage in a wide array of activities enables the banks to utilize the apparent synergies from combining different functions and makes the banks more efficient, thus enabling the banks to provide better services for the nonfinancial sector. A well functioning nonfinancial sector will also create more stability for the banking sector.

Even tough, the theoretical arguments for both sides seem logical and convincing, the majority of the empirical evidence thus far has been quite unanimous. The studies by Barth Caprio and Levine (2001 and 2004), Beck, Demirgüc-Kunt, and Levine (2006), Laeven and Levine (2006) and Schaeck, Čihák and Wolfe (2006) show that regulations restricting banks' abilities to engage in other than the traditional interest-based activities create more instability in the banking sector. Thus, following previous studies, I posit that:

H1. *Countries with regulations that impose tighter restrictions on the ability of commercial banks to engage in securities, insurance, real estate activities and the ability to own nonfinancial firms have more fragile banking sectors.*

3.2 Regulations discriminating foreign banks

Many countries attempt to protect domestic banking sectors by limiting the presence of foreign banks in the market. This can be done by erecting barriers to entry for foreign banks, restricting foreign ownership of domestic bank assets or limiting the ways foreign banks can operate. Foreign bank presence can disrupt the stability of the domestic banking sector by introducing a new source of banking crisis contagion by withdrawing from the domestic banking market when conditions in their home country deteriorate. Foreign banks may also have a lower long-term commitment to the host country and could withdraw its capital from the host country at the first signs of trouble. Some argue that the flight of foreign bank capital was one of the key factors in causing banking crisis in Southeast Asian countries during the latter part of the 1990s. Furthermore, one of the main reasons to limit foreign bank entry is to protect domestic banks from competition. Large foreign bank presence and low entry barriers for foreign banks increase competition in the domestic banking sector, as demonstrated by Claessens, Demirgüc-Kunt and Huizinga (2001) and Levine (2004), which creates instability in the banking system according to the proponents of the competition-fragility view.

On the other hand, large foreign bank presence can actually be beneficial for banking sector stability. Foreign bank entry improves the quality of the financial services in the domestic market, enables the application of more modern banking skills and technology in risk management, enhances a country's access to international capital and stimulates the development of banking supervisory practices. The intensified competition caused by foreign banks will also reduce banking sector fragility, following the argument of the proponents of the competition – stability view. To the best of my knowledge, there have not yet been any studies investigating the effects that regulations limiting the entry and operations of foreign banks have on the stability of the banking sector. Previous studies have used foreign ownership of domestic banking assets and the fraction of foreign entry applications denied measure for how easy it is for foreign banks to enter and operate in the domestic market. Barth, Caprio and Levine (2004) find that extensive foreign ownership of banks do not have a

significant effect on banking distress, whereas Bongini, Claessens and Ferri (2001) document that foreign ownership decreases the probability that and individual bank will experience financial distress. Because there are no earlier directly comparable studies, I follow the central proposition of my thesis and posit that:

> **H2.** *Countries with more regulations that discriminate foreign banks by imposing additional regulatory entry and operations requirements and restrictions have more fragile banking sectors.*

3.3 Regulations imposing entry requirements

National banking supervisory authorities impose strict entry requirements and require a large amount of information from new banks trying to enter the market, before deciding upon whether or not to grant a banking license for the new entrant. The more information is required, the better screening of banks can be performed by the supervisory authorities. Imposing strict entry requirements guarantee that new banks entering the market have to be safe and sound with efficient internal operations and well equipped to handle external shock. If through this enhanced screening process the entry of weak banks can be prevented, more entry requirements will have a beneficial effect on banking sector stability.

However, some argue that extensive entry requirements creates insurmountable barriers to entry, decreasing the threat of new entrants facing incumbent banks and decreasing the competition in the banking sector, as demonstrated by Claessens and Laeven (2004). In addition, more entry requirement means that the banking supervisors have more power and excuses to deny the license from a new bank. Djankov, La Porta, Lopez-de-Silanes and Shleifer (2002) argue that in countries with high levels of corruption, national authorities can use the tight regulations to further their own political goals. The decreased competition and corruption will increase bank distress and fragility, according the proponents of the competition – stability view. The empirical studies by Barth, Caprio and Levine (2004) and Beck, Demirgüc-Kunt and Levine (2006) find that greater entry requirements are associated with higher probabilities of experiencing banking crises. Thus, I posit that:

H3. *Countries with more regulations imposing stricter entry requirements for new banks entering the market have more fragile banking sectors.*

3.4 Summary

Table 1 summarizes the hypotheses that will be tested in my thesis. The three regulatory variables are given a name that will be used in the regression specifications in the following sections. The table also summarizes previous empirical studies that give support to the theories and hypotheses presented.

Table 1: Summary of hypotheses

The table summarizes the hypotheses formulated in Section 3. The first column presents the hypotheses number, second column gives the name to the regulatory variable that is used in the regression specifications. The third column summarizes why larger values of the variable, namely more stringent regulations and restrictions, reduces competition in the banking sector. Column four presents how larger values of the variables are expected to impact the fragility of the banking sector. The table also previous presents empirical studies supporting the hypotheses.

Hypotheses	Regulatory variable	Why reduces bank competition	Impact on banking sector fragility
H1.	**Activity restriction**	Decreases intra-industry competition and synergy gains	**Increases fragility (+)**
	Empirical evidence	Claessens et al. (2004) Bikker et al.(2007)	Barth et al.(2001) Beck et al.(2006) Laeven et al (2006) Schaeck et al.(2006)
H2.	**Foreign bank discrimination**	Reduces the threat from foreign banks and adoption of new banking skills	**Increases fragility (+)**
	Empirical evidence	Claessens et al. (2001) Levine (2004)	No directly comparable studies
H3.	**Entry requirements**	Reduces the threat from new entrants	**Increases fragility (+)**
	Empirical evidence	Claessens et al. (2004)	Barth et al. (2004), Beck et al. (2006)

4. Data

This section is aimed at describing the data and the variables used in the thesis. The first subsection describes the data sources for the banking regulatory variables and how these variables are constructed. In the second part of this section I provide a description of the dependent variable, namely the ratio of non-performing loans to total loans. Next, I introduce the independent control variables that are used in the regression models. Finally, the fourth part provides descriptive statistics and the correlation matrix for all the variables.

4.1 Banking regulatory variables

The two sources of the banking regulation variables used in this thesis are the databases constructed by Barth, Caprio and Levine in 2001, 2003 and 2007, called the BCL database, and Barth, Marchetti, Nolle and Sawangngoenyuang (2007), called the BMNS database. The values for the *Activity Restriction* and *Entry Requirements* variables are obtained from the BCL database. The values for the *Foreign Bank Discrimination* variable are obtained from the BMNS database. The first part of this subsection briefly introduces the three surveys done by BCL. In the second part, the ways in which the *Activity Restriction* and *Entry Requirement* variables are constructed are presented. In the last part of this subsection, I will elaborate more on the BMNS database and the *Foreign Bank Discrimination* variable. The values of these banking regulation variables for each country are presented in Appendix 1.

4.1.1 Banking regulation survey by Barth, Caprio and Levine

Barth, Caprio and Levine have assembled a database on the regulation and supervision of banks in over 150 countries based upon surveys sent to each country's national bank supervisory authorities. The authors have done three surveys altogether, each of which depicts the national banking regulatory situation in different years. The initial survey (Survey I) was constructed in 2001. The initial survey had 117 country respondents and consisted of about 180 questions, which were sent to appropriate individuals at national regulatory and supervisory agencies. The regulatory data mainly reflects the regulatory situation in year 1998 – 1999. This first update, Survey II, was conducted in 2003 and reflects mainly the regulatory situation in different countries at the end of 2002. The updated version substantially expanded the questions send to the regulatory authorities, with approximately 275 questions and had 152 countries participating in the survey. The latest update, Survey III, sought to characterize the regulatory situation in 2006 with over 300 question and 142 countries responding. The questions in all of the three surveys can be separated into twelve sections, covering different aspects of a country's banking system[11]. The majority of the questions are structured to be in a yes or no format, or otherwise require a precise, often quantitative, response.

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[11] The following aspects are covered by the surveys: Entry into banking, Bank ownership, Capital requirements, Activities restrictions, External auditing requirements, Internal management/organizational requirements,

Due to the qualitative nature of the surveys, there arises the issue of the accuracy of the responses. Barth et al. sent the questionnaires to the principal Basel Committee on Bank Supervision contact in each country. As the authors have noted, these contacts should know the regulatory environment, but due to the large scope of the surveys it is impossible for any one person to know the full answer to all of the questions. Thus there might be the danger that some or all of the members of the contact group might change over time, raising the issue of differences in the interpretation of questions over time. In order to achieve the greatest possible accuracy and consistency, the authors adopted several approaches: going back to authorities for clarification and also posting the survey responses on the web, so that the data could be challenged and inconsistencies resolved. Another issue arising is that survey information reflects whether laws or regulations are on the books, but do not necessarily depict to what extent the regulations are implemented in practice.

4.1.2 Activity Restriction and Entry Requirements variables

The individual answers in the BCL surveys are of interest in their own right, but for research use a greater degree of grouping, aggregation and quantification of the variables is needed. Barth et al. have also developed a set of methods in aggregating the survey questions into broader indexes that reflect the stringency of the bank regulations governing different aspects of the banking sector. The construction method of the two out of the three banking regulatory variables, *Activity Restriction* and *Entry Requirements* variables, used in this thesis follows the aggregating methods developed by Barth, Caprio and Levine (2001), and the same method is used in all of the previous studies. The authors note, that this is by no means the only aggregating method, but this approach has been regarded as the best method by experts in the field. Because the authors conducted three surveys, it is possible to calculate the values of these regulatory variables in three different years, in year 1999, 2002 and 2006 and also the changes that have occurred. Next, I present in greater detail how these four variables are constructed.

Liquidity and diversification requirements, Depositor (savings) protection schemes, Provisioning requirements, Accounting/information disclosure requirements, Discipline/problem institutions/exit and Supervision.

Activity Restriction

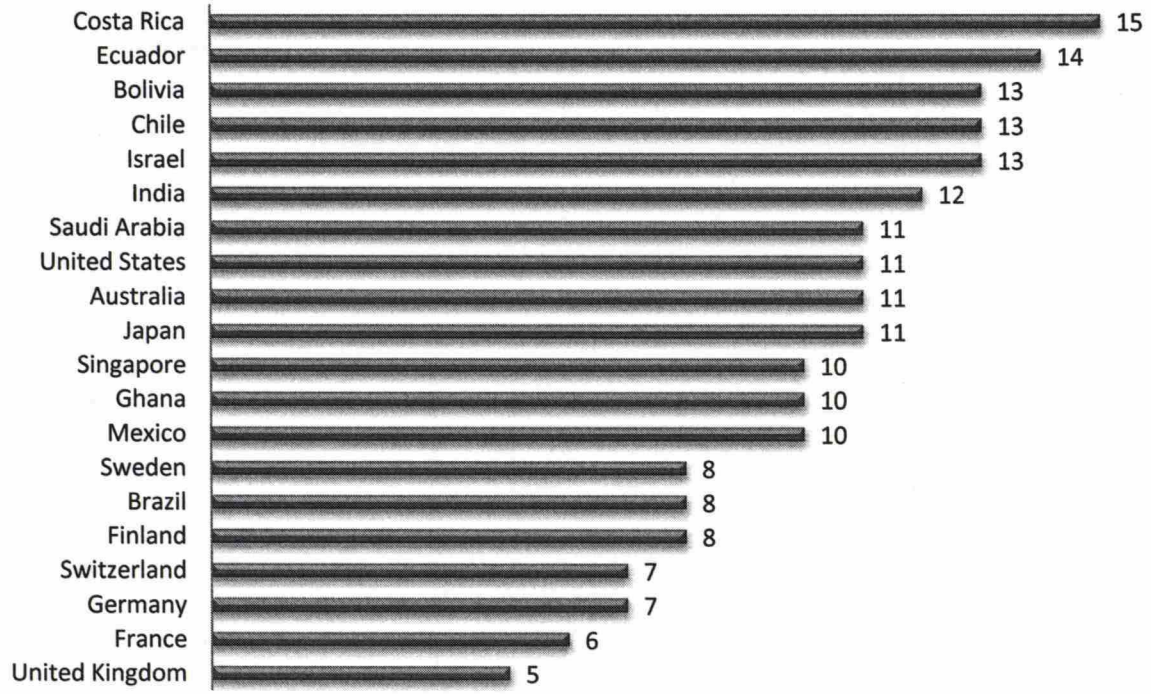
This variable is aimed at measuring the extent to which the national banking regulatory authorities impose restrictions on the ability of commercial banks to engage in securities, insurance and real estate activities. These activities are different from the rather traditional interest spread-based functions, which is the main function of the commercial banks. In addition, this variable also measures the extent to which national authorities restrict commercial banks' abilities of owning and controlling non-financial firms. These types of regulations determine the degree to which a bank can diversify its business operations and its ability to capitalize on any synergies arising from combining complimentary activities. Therefore, the *Activity Restriction* variable is comprised of four components:

a) Securities: banks' ability to engage in investment banking activities.
b) Insurance: the ability of banks to engage in insurance underwriting.
c) Real Estate: banks' ability to engage in real estate businesses.
d) Banks owning nonfinancial firm: the ability of banks to own and control nonfinancial companies.

The BCL databases provide information on how much each country's regulatory framework permits commercial banks to engage in the four activities. Using the database, the degree of regulatory restrictiveness for each of the four activities can be quantified on a scale ranging from 1 to 4, with larger numbers representing greater restrictiveness. The values 1, 2, 3 and 4 mean that the activity is unrestricted, permitted, restricted and prohibited, respectively. The numeric value for the overall *Activity Restriction* variable is the sum of the values of the four measures of bank activity restrictions. Thus, the value Bank Activity Restriction ranges from 4 to 16, with 4 meaning non-existent restriction on banking activities and 16 meaning that other than the traditional functions are fully prohibited. Figure 2 shows the year 2002 value of the *Activity Restriction* variable for selected countries. Appendix 1 presents the values for every country. As Figure 2 shows, there is significant deviation in the value of the variable among different countries.

Figure 2: Value of the Activity Restriction variable in 2002 for selected countries

The figure plots the value of the Activity Restriction variable for selected countries, with higher values indicating more restrictions. The variable is constructed from the database by Barth, Caprio and Levine in 2003 and depicts the regulatory situation in year 2002.



Entry Requirements

This variable aims at measuring the amount of requirements and barriers restricting the entry of new banks. The variable captures the ability and ease for new banks to enter the business by measuring the amount of legal submission that banks need to deliver in order to obtain banking licence. A greater amount of required documents might imply a greater quality of new entrants, which might be beneficial for the stability of the banking sector. But more requirements also mean that there are more barriers of entry to the banking sector and more grounds for rejecting a request, which hinders competition. These requirements affect both domestic and foreign banks. There are eight requirements taken into account:

1.) Draft-by-laws
2.) Intended organizational charts
3.) First 3-year financial projections
4.) Financial information on main potential shareholders
5.) Background/experience of future directors

6.) Background/experience of future managers

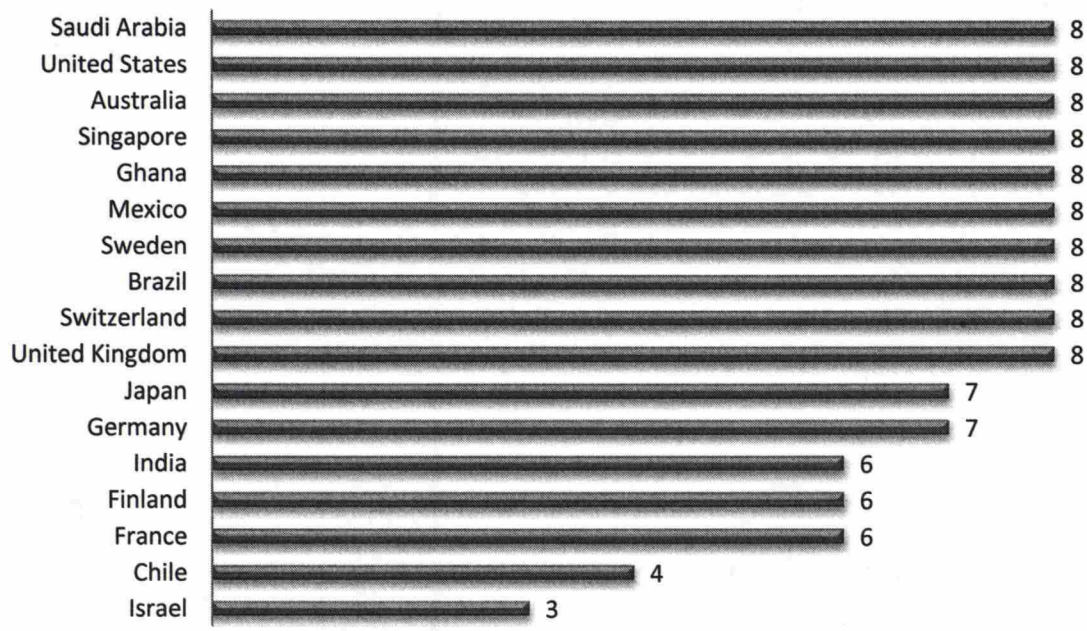
7.) Sources of funds to be used to capitalize the new bank

8.) Intended differentiation of the new bank from other banks

If banks are required by the national authorities to deliver one of the documents a value of 1 is assigned and 0 otherwise. Thus, a country with higher values has more entry requirements for new banks. The value of the overall *Entry Requirement* variable is the sum of the eight requirements. The variable's values range from 0 to 8, with larger values indicating more barriers of entry for new banks. Figure 3 shows the year 2002 value of the *Entry Requirements* variable for selected countries. As Figure 3 depicts, there is less deviation in the values of the *Entry Requirements* variable among different countries, as compared to the *Activity Restriction* variable. Many of the countries in the sample require new banks to deliver information on all of the eight requirements. The largest exception is Israel, which requires new applicants to only submit three documents. Appendix 1 presents the values for every country.

Figure 3: Value of the Entry Requirements variable in 2002 for selected countries

The figure plots the value of the Entry Requirements variable for selected countries, with higher values indicating more entry requirements. The variable is constructed from the database by Barth, Caprio and Levine in 2003 and depicts the regulatory situation in year 2002.



4.1.3 BMNS database and Foreign Bank Discrimination variable

The database constructed by Barth, Marchetti, Nolle and Sawangngoenyuang (2007) has data on how well the member countries of the World Trade Organization (WTO) have committed to the implementation of GATS[12] agreements in their domestic banking sectors. This comprehensive dataset documents how well the member countries are committed to these financial services sector accords, whose main aim is to induce the liberalization of financial services in each country and to eliminate trade barriers between member states. The key objective of the GATS agreements is to persuade member countries to treat both foreign and domestic service companies equally.

The dataset contains cross-country data on how countries treat domestic and foreign banks differently in the national banking sector. The database includes information on the following aspects: whether or not individual countries impose different capital requirements between domestic and foreign banks; are some methods of entry for foreign banks denied, for example via the acquisition of an existing bank in the host country or the establishment of a subsidiary or via branching; are the expansion methods of foreign banks restricted after entry, for example through additional offices, branches, and ATMs; whether there are limitations on the share of the banking assets which can be foreign-owned; whether there are limitations on foreign ownership of the equity of individual banks; and whether the requirements for the composition of the bank's board of directors is different from the requirements for domestic banks.

Based on the database, the authors have calculated a variable, *Foreign Bank Discrimination*, which measures the degree of discrimination between foreign and domestic banks. The higher the value of this variable is in a particular country, the greater are the banking regulation related disadvantages imposed on foreign banks operating in this market. The value of the regulatory variables range from 0 to 60. The period under consideration is after 1997, when the GATS agreements were first signed. Figure 4 shows the value of the *Foreign Bank Discrimination* variable for different countries. The figure shows that there considerable

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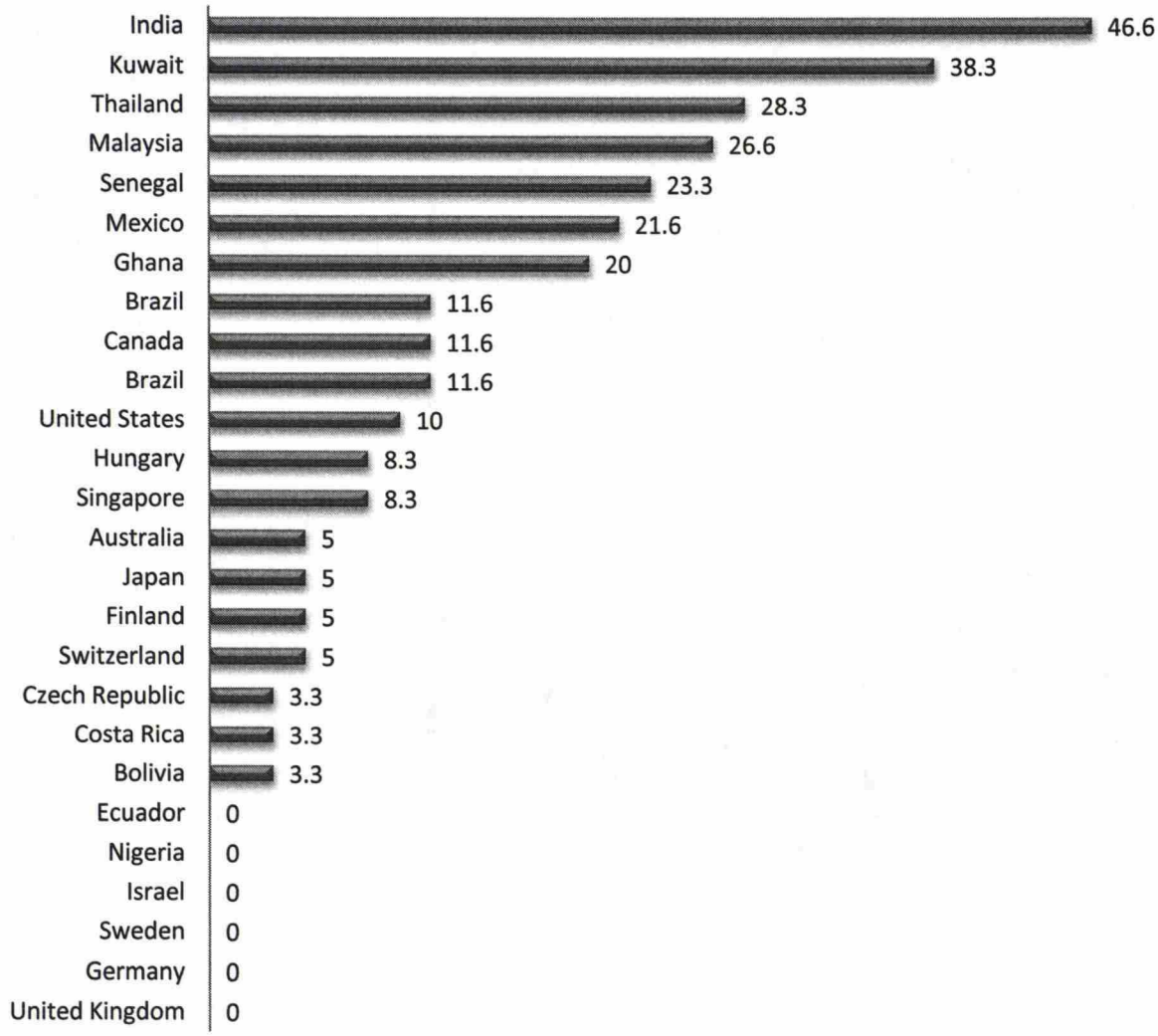
[12] General Agreement on Trade in Services, which is a multilateral trade agreement aimed at liberalizing international commerce in services.

deviation among different countries in the values of the variable, ranging from 46.6 in India to 0 in the United Kingdom. Appendix 1 presents the values for every country.

Figure 4: Value of the Foreign Bank Discrimination variable for selected countries

The figure plots the value of the *Foreign Bank Discrimination* variable for selected countries, with higher values indicating more discrimination. The variable is constructed from the database by Barth, Marchetti, Nolle and Sawangngoenyuang (2007) and depicts the regulatory situation after year 1997.



4.2 Dependent variable: non-performing loans to total loans

The dependent variable used in this thesis is the ratio of the non-performing loans (NPL) to total loans in the banking industry which acts as a proxy for the fragility of the banking sector. The level of non-performing loans have been, either explicitly or implicitly, used as a measure

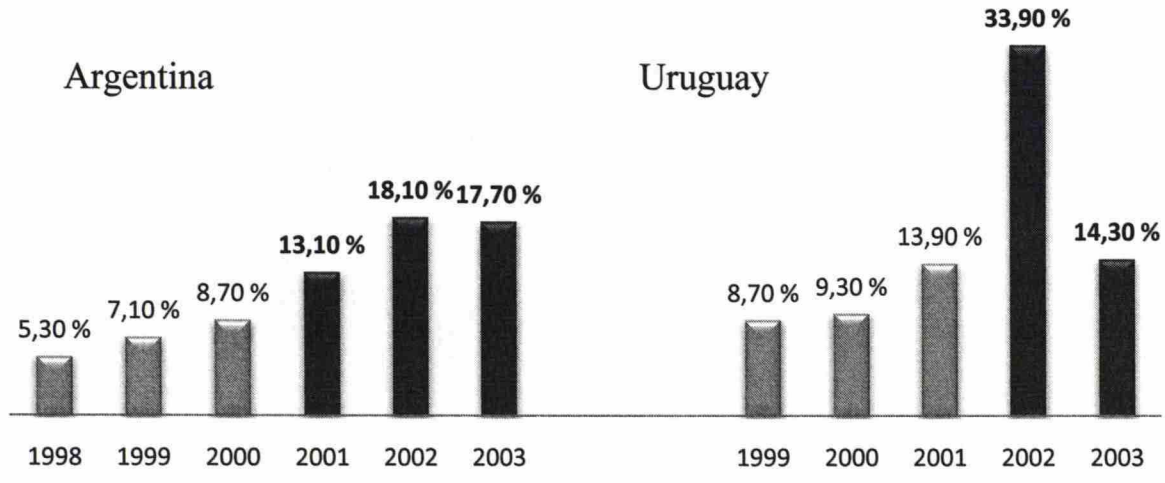
of banking sector fragility by Demirgüc-Kunt and Detragiache (1998, 2002), Barth, Caprio and Levine (2004) and Das, Quintyn and Chennard (2004) and Popdiera (2004), to name just a few. The level of NPLs signals the quality of the financial institutions' portfolios in the economy and how the banks are able to perform one of their main functions, namely to collect back the money they have lend. Even though there might be several reasons for a high ratio of NPLs, it still almost always signals that there are serious problems in the banking sector.

Systematic banking crisis can be the ultimate manifestation of banking system fragility, but because it can happen for many reasons, from severe business-cycle downturns to excessive lending booms, it can take place for reasons not directly related to the fragility of the domestic banking. However, because the level of NPLs measures the quality of the banks' portfolios, it also represents how well the banking sector can weather a crisis by having strong balance sheets that can absorb any severe shocks. The higher is the level of NPLs in the banking industry, the more prone it is to the occurrence of banking crisis and more fragile to both internal and external blows. Therefore, the ratio of non-performing loans can be regarded as a continuous measure for the fragility of the banking system.

Countries experiencing a banking crisis will naturally have an extremely high ratio of NPLs during and after the crisis period, but an increase in the ratio of NPLs can also act as an indicator and predictor for the occurrence of crises in the following periods. González Hermosillo (1999) documents, by examining individual banks' balance sheets during several crisis episodes, that soon before crises occurs there is a growth in non-performing loans signalling growing financial distress. In general, the author discover that a high level of NPLs increase the probability of bank failure and distress and reduce the expected survival time of individual banks. I do not have long enough cross-country time-series for the level of NPLs to perform any robust quantitative analysis on the relationship between the growth of NPLs and the subsequent occurrence of crises. There is only data on the level of NPLs for the three year before for two crisis episodes, Argentina (2001) and Uruguay (2002). Figure 5 plots how the level of non-performing loan develops prior to the occurrence of the crises episode. Figure shows that, at least for these two crisis episodes, there is a clear growth in the level of NPLs before a full-blown crisis occurred.

Figure 5: Development of NPLs prior crisis episodes in Argentina and Uruguay

The figure plots how the level of non-performing loans develops in the three years preceding the occurrence of a systematic banking crisis. There are two crises episodes depicted: Argentina in year 2001 and Uruguay in year 2002. The light columns show the level of NPLs before the crises years and the dark columns show the level during the crises years. The data on NPLs is obtained from the Global Financial Stability Reports published by the International Monetary Fund.



The main advantage of this indicator is that it is a continuous variable measuring the degree of fragility and instability in the banking sector. The ratio of NPLs will also indentify the weaknesses and vulnerabilities that can beset the aggregate balance sheets of financial institutions for a long time before being realized by some exogenous shock. The biggest disadvantage with using the ratio of NPLs as an indicator for banking sector vulnerability is that due to the differences in national accounting, taxation, and supervisory regimes, the data and the definition of NPLs are not strictly comparable across countries. There could also be problems in comparing the NPL ratios of the same country between different periods, due to the differences arising from the coverage, changes in regulations, accounting standards and data compilation methods in the country over time. Also, in countries with weak accounting standards, the accuracy and the reliability of the data could be affected. However, because accounting standards are usually weak in countries that have high levels of NPLs, the data should bias towards not finding any significant relationship.

I have obtained the data for the percentage of non-performing loans to total loans from the Global Financial Stability Reports (GFSR) published by the IMF. Because of difficulties of cross-country and across time comparisons, the IMF has developed a set of uniform guidelines in defining non-performing loans that all countries have to follow when submitting

the data[13], though not all countries follow these guidelines. The data for the ratio of NPLs are measured at an annual basis and the time coverage is for the period of 1998 – 2007. There are data for 80 countries, though the values of NPLs are not available for every year for some countries.

4.3 Control Variables

This subsection presents the independent variables used in the regression models to control for other factors than the regulatory variables that might affect the level of non-performing loans. The control variables employed in this thesis are in line with the earlier empirical studies that have found these variables to have a significant impact on the fragility of the banking sector. Demirgüc-Kunt and Detragiache (2005) provide an excellent survey of the literature. These control variables can be roughly aggregated in three groups: institutional, macroeconomic and financial system variables. The institutional variables are aimed at controlling for the cross-country differences in the institutional quality, the macroeconomic control variables are used to capture the effect of exogenous shocks and the financial system variables control for the effect of cross-country differences in the different features of the financial system. Because the loan defaults and losses happen with a lag and do not appear on banks' balance sheets immediately, all the control variables are lagged with for two years. The majority of the data is collected from the World Bank's World Development Indicators (WDI) database and International Monetary Fund's International Financial Statistics (IFS) database.

Institutional variables

GDP per capita is included as a general indicator for the institutional development, with higher values indicating better institutional quality. Higher institutional development will produce well-functioning and efficient institutions that have a beneficial effect on banks operating within it and thus promoting the stability of the whole banking sector. Thus higher values of GDP per capita should be associated with lower levels of non-performing loans.

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[13] See IMF's *Financial Soundness Indicators: Compilation guide (2006)* for the classification of non-performing loans.

Das, Quintyn and Chennard (2004) provide evidence of the beneficial effects of good quality institutions on the performance of the banking sector. The data is from the WDI database.

KKZ-index is an additional measure for the overall institutional quality, obtained from Kauffman, Kraay and Mastruzzi (2005). The underlying indicators of this index are six measures aimed at capturing different dimensions of the institutional development. These six dimensions are voice and accountability, government effectiveness, political stability, regulatory quality, rule of law and control of corruption. The higher the KKZ-index the better is the institutional environment of a given country. Thus it is expected that higher KKZ-indexes are associated with lower levels of NPLs.

Macroeconomic variables

Growth rate of real GDP is used to capture the adverse macroeconomic shocks that hurt banks and increases the share of non-performing loans. When the economy is doing well, companies' profits are high and their ability to repay their loans is strong. If the economic growth is slowing down, there are fewer profit opportunities for companies, which might cause them to default on their debt obligations. Thus, it would be expected that the higher growth rate of GDP would be associated with lower levels of non-performing loans. *Volatility of the growth rate of GDP* is also included as a control variable. Higher volatility could imply a less stable economy resulting in instable banking sectors. The data is obtained from WDI.

Inflation is introduced as an explanatory variable because it will proxy macroeconomic mismanagement, which adversely affects the economy and the banking system through various channels. Thus, higher inflation is expected to have a positive effect on the level of non-performing loans and negative effect on the stability of the banking market. Inflation is calculated as the percentage change of the GDP deflator and the data is collected from WDI.

Change in real interest rate is included in the regression because it affects banks' balance sheets adversely if banks cannot increase their lending rates quickly enough. Also, an increase in real interest rates is expected to have an adverse effect on the borrowers' situation, because the costs of loan repayments will be more expensive. In addition, the real interest rate may also be considered as a proxy for financial liberalization, as liberalization process tends to

lead to high real rates. Financial liberalization, in turn, may increase banking sector fragility because of increased opportunities for excessive risk-taking and fraud (Allen, 2001). Thus, higher real interest rates should be associated with higher levels of non-performing loans and instability. The primary nominal interest rate used is the treasury rate. For those countries that treasury rates were not available, bank discount rates were used instead. If the bank discount rates were not available the deposit rates were used. This procedure is similar to that of Demirgüc-Kunt and Detragiache (1998 and 2002). The real interest rate is obtained by subtracting inflation from the nominal interest rates. Nominal interest rate data is collected from IFS.

Currency Depreciation is entered into the equation to control for the banking problems caused by excessive foreign exchange risk exposure either among banks or their borrowers. Especially, if banks that raise funds abroad choose to issue domestic loans denominated in foreign currency in order to eliminate their open position, currency depreciation will raise the cost of the borrowers' debt and thus increasing the ratio of non-performing loans. Large exchange rate deprecation could also signal general economic instability. It is probable that the currency depreciation has a positive effect on the level of NPLs. The currency rate is calculated as the national currency units per a unit of the U.S. dollar, thus positive values indicate depreciation. The data is collected from IFS.

Financial system variables

Government ownership measures the fraction of the banking system's assets that are 50% or more government owned. This variable is included to capture the effect of government involvement in the banking industry. Greater state-ownership might lead to more inefficiency and impede competitive behavior of financial institutions. Therefore higher degrees of government involvement in the banking sector should be associated with higher levels of NPLs and instability. The data is collected from the BCL surveys in 2001, 2003 and 2006. Whenever there are missing values, the dataset is supplemented by La Porta, Lopez-de-Silanes and Shleifer (2002).

Foreign ownership measures the fraction of the banking system's assets that are 50% or more foreign owned. Higher degrees of foreign ownership might create more competitive

environment and efficient banks. Therefore higher degrees of foreign involvement in the banking sector should be associated with lower levels of NPLs and instability. The data is collected from the BCL databases done in 2001, 2003 and 2006. Whenever there are missing values, the dataset is supplemented by Claessens, Demirgüc-Kunt and Huizinga (2001).

Domestic private credit to GDP is introduced in the regression to act as a proxy for both the progress of financial liberalization and the development of the domestic credit market. On one hand, a large ratio of domestic private credit to GDP implies a higher degree of financial liberalization in the economy, which in turn might lead to increased opportunities for excessive risk-taking and fraud for the banks. Kaminsky and Reinhart (1999) document that banking crises are preceded by financial liberalization and excessive credit growth. This should create a positive correlation between the ratio and the levels of NPLs. On the other hand, higher ratio also implies that there is a more developed credit market with more experienced and efficient banks. This should lead to a negative correlation between the ratio and NPLs. Thus, the effect of the ratio of domestic private credit to GDP is unambiguous. The data is collected from WDI.

Stock market capitalization to GDP is included in the regression because a country with better functioning capital markets might create a more competitive environment for the banking sector. This effect could be either beneficial or hazardous for the stability of the banking sector, thus its coefficient is unambiguous. The data is collected from the Financial Structure Dataset (2006).

Insurance deposit scheme variable takes the value of one if the country has an explicit insurance deposit scheme in place and zero otherwise. Explicit deposit insurance might be an optimal instrument in preventing self-fulfilling depositor runs and bank failures. However, deposit insurance can also be a source of moral hazard for banks. As the banks' abilities to attract depositors do not reflect the risk of their asset portfolios, they have more incentive to finance high-risk, high-return projects. Thus explicit deposit insurance schemes might lead to more bank failures and instability in the banking sector (Demirgüc-Kunt and Detragiache, 2002). In line with previous research, it is expected that explicit deposit insurance schemes create higher levels of NPLs. This variable is collected from Demirgüc-Kunt, Karacaovali and Laeven (2005).

Bank concentration equals the fraction of bank assets held by the three largest commercial banks as a share of assets of all commercial banks in the country. Many previous studies have found that high concentration in the banking sector can have both a positive and a negative effect on banking stability. The data is obtained from the Financial Structure Dataset (2007) published by the World Bank and constructed by Beck and Al-Hussainy.

4.4 Summary Statistics

Table 2 present the descriptive statistics for the variable used in this thesis and Table 3 presents the correlation coefficients between the variables. As Table 3 demonstrates, there is a significant correlation between several variables, hence multicollinearity could be an issue.

Table 2: Descriptive statistics

The table presents the number of observations, mean, standard deviation, minimum and maximum of the variables used in the thesis. The sample includes 80 countries. *NPLs* measure the ratio of non-performing loans to total loans for the period of 1998 – 2007. *Activity Restriction* and *Entry* depicts the regulatory situation in year 1999, with larger values indicating more stringent regulations. *Foreign Bank Discrimination* depicts the regulatory situation after 1997, with larger values indicating more discrimination. *Per Capita GDP and KKZ-index* both measures the institutional quality of a country, with higher values indicating better institutions and are measured with a two year lag. *Real GDP Growth, Currency Depreciation* (the rate of change of the national currency against the US dollar, with positive values indicating depreciation), *Inflation* (rate of change of the GDP deflator) and *Real Interest Rate growth* are all calculated as the rate of change for the previous two years. GDP growth volatility is calculated during the period of 1998 – 2007. *Government* and *Foreign ownership* measures the fraction of the banking system's assets that are 50% or more government and foreign owned, respectively. *Private Credit to GDP* and *Stock Market Cap to GDP* variables are both measured with two year lag. Concentration equals the fraction of bank assets held by the three largest commercial banks as a share of all assets. Insurance Deposit Scheme takes the value of 1 if the country has an explicit insurance deposit scheme and 0 otherwise.

Variable	Mean	Std.dev.	Minimum	Maximum	Observation
NPLs	0,08	0,08	0,00	0,49	753
Activity Restriction	9,34	2,36	5,00	14,00	650
Entry Requirements	7,23	1,23	2,00	8,00	650
Foreign Bank Discrimination	7,52	10,85	0,00	46,60	690
Per Capita GDP	13135,69	10643,73	616,43	55217,71	800
KKZ - index	0,50	0,89	-1,18	1,99	800
Real GDP growth	0,08	0,08	-0,16	1,50	794
GDP growth volatility	0,03	0,02	0,00	0,09	800
Currency depreciation	0,07	0,21	-0,63	0,99	748
Inflation	0,22	1,03	-0,29	22,15	794
Real interest rate growth	0,01	0,55	-8,56	8,72	770
Government ownership	0,25	0,22	0,00	0,99	518
Foreign ownership	0,34	0,29	0,01	0,99	734
Stock market cap to GDP	0,55	0,63	0,00	5,28	715
Private credit to GDP	63,08	49,00	1,39	255,31	793
Deposit insurance scheme	0,76	0,43	0,00	1,00	800
Bank concentration	0,61	0,19	0,17	0,99	780

Table 3: Correlation matrix

The table presents the pairwise correlation coefficients between the variables used in this study. For each coefficient, ***, **, and * indicate that the coefficient is different from zero at the 1%, 5% and 10%-levels, respectively. The sample includes 80 countries. *NPLs* measure the ratio of non-performing loans to total loans for the period of 1998 – 2007. *Activity Restriction* and *Entry Restriction* are depicts the regulatory situation in year 1999, with larger values indicating more stringent regulations. *Foreign Bank Discrimination* depicts the regulatory situation after 1997, with larger values indicating more discrimination. *Per Capita GDP and KKZ-index* both measures the institutional quality of a country, with higher values indicating better institutions and are measured with a two year lag. *Real GDP Growth, Currency Depreciation* (the rate of change of the national currency against the US dollar, with positive values indicating depreciation), *Inflation* (rate of change of the GDP deflator) and *Real Interest Rate growth* are all calculated as the rate of change for the previous two years. GDP growth volatility is calculated during the period of 1998 – 2007. *Government* and *Foreign ownership* measures the fraction of the banking system's assets that are 50% or more government and foreign owned, respectively. *Private Credit to GDP* and *Stock Market Cap to GDP* variables are both measured with two year lag. Concentration equals the fraction of bank assets held by the three largest commercial banks as a share of all assets. Insurance Deposit Scheme takes the value of 1 if the country has an explicit insurance deposit scheme and 0 otherwise.

	Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
(1)	NPLs	1																
(2)	Activity Restriction	***0.3694	1															
(3)	Entry Restrictions	0.0367	-0.0484	1														
(4)	Foreign Bank Discrimination	***0.3647	***0.221	***-0.1125	1													
(5)	Per capita GDP	***-0.5153	***-0.4455	*-0.0738	***-0.311	1												
(6)	KKZ-index	***-0.5481	***-0.486	***-0.1665	***-0.3407	***0.8709	1											
(7)	Real GDP growth	*-0.0635	0.054	-0.0052	***0.1083	***-0.2019	***-0.1965	1										
(8)	Currency depreciation	***0.3293	***0.1512	0.0469	0.0451	***-0.2914	***-0.2988	0.0129	1									
(9)	Inflation	***0.1274	***0.1102	*0.0684	-0.0001	*-0.1191	***-0.1578	**-0.0884	***0.3988	1								
(10)	Real interest rate growth	0.0604	0.0354	0.015	0.0006	-0.0218	-0.0443	0.0175	*-0.0629	***-0.4235	1							
(11)	GDP volatility	***0.1704	0.0602	0.0396	0.0838	***-0.3297	***-0.4084	***0.1887	***0.223	***0.0964	0.0033	1						
(12)	Government ownership	***0.3019	***0.3525	***-0.2215	***0.2374	***-0.3375	***-0.3293	***0.102	***0.2597	***0.1298	0.0261	**0.0916	1					
(13)	Foreign ownership	-0.0552	***-0.1443	***0.1385	**-0.0954	***-0.1999	***-0.1515	**0.0709	***-0.1037	0.0372	-0.0192	***0.1289	***-0.2756	1				
(14)	Private credit to GDP	***-0.2617	***-0.2099	*-0.0683	***-0.1036	***0.6522	***0.6506	***-0.1682	***-0.2496	***-0.1258	-0.055	***-0.2467	***-0.2609	***-0.2976	1			
(15)	Stock market cap to GDP	***-0.2878	***-0.332	**-0.0914	-0.0327	***0.5307	***0.5127	-0.0466	***-0.1307	***-0.0968	0.0048	**-0.0839	***-0.3024	-0.0573	***0.6479	1		
(16)	Deposit insurance scheme	**-0.0924	***-0.2852	0.0573	***-0.2279	***0.1336	***0.127	*-0.0672	0.0434	0.0519	0.0077	-0.0117	***-0.1477	-0.0185	0.0251	***-0.1635	1	
(17)	Concentration	**-0.0845	*-0.0667	0.0352	***-0.1594	**0.0817	***0.2135	0.0286	-0.0166	**0.0789	0.0035	***-0.2027	***-0.1145	-0.026	-0.0461	***0.1284	***-0.1979	1

5. Banking crisis and regulatory changes

Before presenting the methodology and the findings of this thesis, a few issues on the causality between bank crisis and the subsequent changes in banking regulations need to be examined. All previous studies [14] that investigate the relationship between banking sector stability and the strictness of bank regulations have assumed that the regulatory environment has remained unchanged during the sample period. Because there is no extensive cross-country time-series database describing the level and the strictness of bank regulations in different countries before 1999, the studies have used the regulatory situation at year 1999[15] for their whole sample period. Because the sample periods in these studies always start before year 1999, sometimes spanning to the end of 1970s, it is implicitly assumed that the bank regulations have stayed constant and unchanged throughout. However, it is quite unlikely that the regulatory environment has stayed constant during the sample periods under consideration, especially for those countries that have experienced severe crisis.

It is highly probable that countries undergoing bank crisis might responded to them by adopting stricter regulatory restrictions governing the banking sector. If this were the situation in some countries, it would be inappropriate to interpret the findings of the previous studies as suggesting that tight regulatory restrictions increase the probability of the occurrence of a crisis. For example, the findings of Beck, Demirgüc-Kunt and Levine (2006) might well be interpreted as indicating that countries which have experienced banking crisis before are more likely to impose strict banking regulations, as opposed to the authors' interpretation that more restrictive regulations result in a higher probability of the occurrence of a banking crisis. If there would be a tendency the practice of imposing restrictive bank regulations following severe banking sector problems, the regulatory variables used should be from the beginning of the sample period and not from the end.

To control for this potential endogeneity issue, many of the studies have used a two-step instrumental variable estimator. However, because instrumental variables are not very good predictors of regulatory restrictions according to Barth, Caprio and Levine (2001), they have

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[14] Barth, Caprio and Levine (2001 and 2004), Beck, Demirgüc-Kunt and Levine (2006), Schaeck, Čihák and Wolfe (2006), Laeven and Levine (2006)

[15] Obtained from the first survey by Barth, Caprio and Levine in 2001. To the best of my knowledge, there are no studies using the data of Survey II or III.

used a more qualitative procedure to examine the issue of endogeneity. Barth et al. investigate whether countries experiencing a banking crisis have implemented any changes in their regulations limiting the banks' abilities to engage in securities, insurance and real estate activities as well as to the mixing of banking and commerce. Based on their findings, the authors argue that banking crisis generally did not induce governments to enact more restrictive regulations. In the majority of crises events studied, no significant changes occurred in the regulations restricting bank activities during or after the crisis episode. Even in the relatively few cases where there was a change, the direction was towards fewer restrictions than actually existed. These results obtained by Barth et al. have been the main, and often the only, argument used by the previous studies to justify their assumption of a constant regulatory environment.

Even though the research implemented by Barth, Caprio and Levine gives valuable insight into the causality issue, their investigation has several shortcomings. First of all, the authors concentrated solely on the changes in the regulations restricting banks' abilities to engage in other functions than the traditional credit channeling. In response to a banking crisis, national authorities can also restrict other aspects of the regulatory framework, for example entry barriers. Furthermore, the crisis countries and episodes covered by Barth et al. are not extensive and lack data on regulatory changes for several countries. An additional problem with the study is that Barth et al. concentrated solely only on the period during or immediately after the crisis. It generally takes a long period of time before national authorities react to a banking crisis by passing new laws, and it takes an even longer period of time to actually implement the new changes in the regulatory framework. Therefore, it would be prudent to examine the effect of banking crisis on regulatory changes by examining a longer timeframe.

To further shed light on the causality issue between regulatory changes and banking crisis, I have conducted an empirical analysis on the differences between changes in bank regulations for countries that have experienced crisis versus those countries that have not. First, using the database compiled by Caprio and Klingebiel (2003), I have separated the sample countries into two groups: those that are experiencing a systematic banking crisis after year 1995 but before 2000 and those countries are not. Caprio and Klingebiel define that a country is experiencing a banking crisis when all or most of the banking system's capital was eroded during the period of the crisis. Next, I calculate the changes in the strictness of bank

regulations between the period of 1999 and 2002 for both of the country groups. It is probable that if a country has experienced banking crisis after 1995, the changes in regulations that have been implemented afterwards can be seen in the years following the crisis episodes, from 1999 to 2002. The situation of the national banking regulatory environment at the end of 1999 and 2002 are obtained from the BCL Survey I and II, respectively. The changes in two bank regulatory variables are investigated: *Activity Restriction* and *Entry Requirements*. The ways how the indexes are constructed are elaborated thoroughly in Section 4.

Figure 6: Changes in banking regulations for crisis and non-crisis countries

The figure plots the average change in two banking regulatory variables between the period of 1999 to 2002 for countries that have experienced a banking crisis after 1995 and before 2000 and for countries that have not. The two regulatory variables are Activity Restriction and Entry Requirements. A positive value means that the particular regulation has become stricter. The definition of whether a country has experienced a banking crisis is obtained from the database constructed by Caprio and Klingebiel (2003). The values for the regulatory variables in year 1999 and 2002 are obtained from the surveys conducted by Barth, Caprio and Levine in 2001 and 2003, respectively.

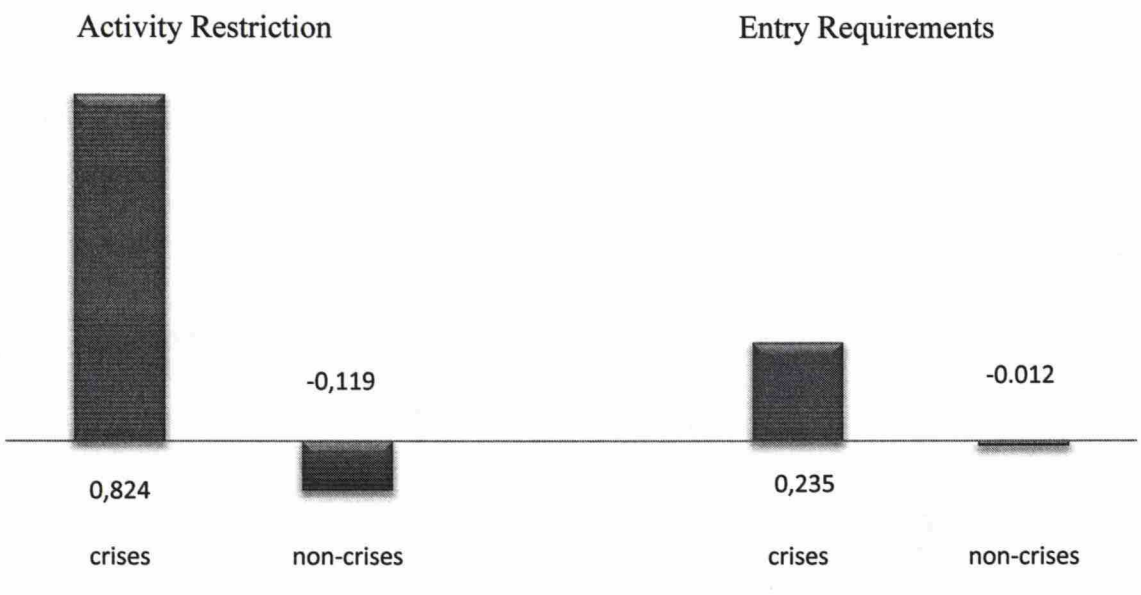

Figure 6 plots the average change in the two variables for both crisis and non-crisis countries, with a positive value indicating that the regulations have become tighter. As the figure demonstrates, there is a clear difference in how banking regulations develop during 1999-2002 between countries experiencing a banking crises after 1995 and for countries that have not. Crisis countries have on average tightened both of the two regulatory variables after crises episodes, whereas non-crisis countries have on average loosened the banking regulations. To further investigate the differences in regulatory changes between crisis and non-crisis countries, I perform statistical tests to see whether there are any statistical differences. Table 4 reports the t-statistics for the differences in means and the z-statistics of

the Wilcoxon rank-sum test for the differences in medians of the changes in banking regulations between crisis and non-crisis countries.

Table 4: Mean and median tests for crisis and non-crisis countries

The table shows the mean change in two banking regulatory variables for the period of 1999 - 2002 for both countries that have experienced a banking crisis after 1995 and for countries that have not. The two regulatory variables are *Activity Restriction* and *Entry Restriction*. A positive value indicates that the regulatory variable has become stricter. The definition of whether a country has experienced a banking crisis is obtained from the database constructed by Caprio and Klingebiel (2003). The values for the regulatory variables in year 1999 and 2002 are obtained from the surveys conducted by Barth, Caprio and Levine in 2001 and 2003, respectively. The table also shows two tailed t-statistics for equality of means and the z –statistics of the Wilcoxon rank-sum test for the equality of medians. The columns *Means (t) and Rank-sum (z)* report the t-statistics and the z –statistics, respectively, for the hypotheses $H_{(0)}$: regulation change crisis countries – regulation change non-crisis countries = 0, correcting for unequal variances. For each test statistics ***, **, and * indicate that the change among crisis countries is significantly different from change among non-crisis countries at the 1%, 5%, and 10% levels, respectively.

	Crisis		Non-Crisis		Difference Test	
Variable	Mean	N	Mean	N	Means (t)	Rank-sum (z)
Activity Restriction	0.825	17	-0.119	84	*1.625	1.277
Entry Regulation	-0.235	17	-0.012	84	1.118	0.917

As Table 5 shows that the change in the *Activity Restriction* variable is significantly larger, at least at a 10% -level, for crisis countries as opposed to non-crisis countries, whereas the median change is not significantly different. The mean and median changes in the *Entry Requirements* variable, however, are not significantly different between the two types of countries. The findings in this section show that there is some evidence that countries that have witnessed a banking crisis have the tendency to tighten their banking regulations subsequently, especially the regulations restricting bank activities. Therefore it would be prudent to use the values of the regulatory variables from the beginning of the sample period to avoid causality issues. Furthermore, the findings of the previous studies investigating the effects of bank activity restrictions on bank fragility clearly need to be re-evaluated.

6. Methodology

The impact of the stringency of banking regulations on the stability of the banking sector is estimated using the ordinary least squares (OLS) regression[16]. The White's test revealed a

[16] All regressions are done using the Stata -statistical program

strong presence of heteroskedasticity and the Durbin-Watson d statistics revealed a strong presence of first-order autocorrelation in the residuals, both very common problems in cross-section time series analyses. Therefore, the Newey-West robust standard errors, which are heteroskedasticity-consistent and first-order autocorrelation corrected, are used in order to obtain an unbiased standard error for the coefficients.

The model used in this thesis of explains cross-country variations in the level of non-performing loans to total loans as a function the country's macroeconomic development, financial system characteristics, institutional quality and, most importantly, the stringency of the banking regulations:

$$\text{NPL to Total Loans}_{i,t} = \alpha + \beta_1 R_{i,t} + \beta_2 M_{i,t} + \beta_3 F_{i,t} + \beta_4 I_i + \varepsilon_{i,t} \qquad (1)$$

where i indexes country i, t indexes time t, $R_{i,t}$ denotes the stringency of the banking regulations in country i at time t, $M_{i,t}$ is a vector for the macroeconomic conditions in country i at time t, $F_{i,t}$ is a vector for the financial system –specific characteristics in country i at time t, I_i denotes the level of the institutional development in country i. Because non-performing loans usually appear on the banks' balance sheets with a delay as compared to the development in the real world, all the control variables are lagged for two years.

Given a set of observations on the level of non-performing loans in different countries and periods of time, the independent variables are fitted into the equation above by minimizing the sum of the squares of the residuals. The regression coefficient of each of the independent variable provides an estimate of its influence on the dependent variable while controlling for the effects of all of the other explanatory variables in the equation. The t-statistics for each of the coefficient tests for the statistical significance of the individual explanatory variable's effect on the dependent variable, with the null hypotheses being $H_{(0)}$: $\beta_k = 0$. The R-square value indicates the explanatory power of the whole model.

7 Empirical results

This section presents and analyses the main empirical results of my thesis. The dependent variable is the ratio of non-performing loans to total loans, which is regressed against the

three bank regulation variables, presented in Section 4, while controlling for a host of macroeconomic and institutional factors. In the first subsection, I present the results of the baseline regressions for each of the three banking regulation variables. In the next subsections, the regression models and samples are modified to see if the results are consistent with those uncovered in the first subsection. The last part of this section presents a summary of the main empirical findings.

7.1 Baseline regressions

In this subsection I present the results of the baseline regressions for each of the three banking regulatory variables. The dependent variable in every specification is the level of non-performing loans to total loans in a country, covering the period of 1998 – 2007. The main sample includes data on 80 countries, including both developed and developing countries and also countries that have experienced banking crises during the sample period. The values for the *Activity Restriction* and *Entry Requirements* variables are from the beginning of the sample period, depicting the regulatory situation around 1998 – 1999. These values are used to avoid the causality issues between regulatory changes and banking crises, which is elaborated in Section 5. Because there is only one set of values for the *Foreign Bank Discrimination* variable, depicting the situation after 1997, these values are used in every regression. Next, I will present the results for each of the three variables separately.

7.1.1 Activity Restriction

Table 5 presents the results for the multivariate OLS regressions when the independent variable of interest is the *Activity Restriction* variable, which measures the degree to which the national banking regulations allow commercial banks to engage in activities that are outside of the conventional functions. The relationship between the variable and NPLs is investigated by first plotting the *Activity Restriction* variable as the sole explanatory variable in the regression model and then adding additional control variables one by one to see if the relationship holds. As Table 5a demonstrates, *Activity Restriction* variable has a positive coefficient in every specification, and remains significant at 1%-level even when a host of macroeconomic and institutional variables are included in the regression. The results indicate

that stricter bank activity restrictions are associated with higher levels of non-performing loans. The findings are consistent with previous empirical studies.[17]

Most of the control variables' coefficients have the expected sign as hypothesized in Section 4. Real GDP per Capita, a proxy for the overall institutional development of a country, has a negative coefficient. Countries that are more developed tend to have lower levels of NPLs and better functioning banking sectors. The negative relationship is robust and significant at 1%-level in every specification. I also run regressions using an alternative proxy for the institutional development of a country. The measure is the KKZ - index, with higher values indicating better institutional quality. Regressions with the KKZ - index as a proxy for institutional quality are presented in the eight and tenth column of Table 5a. Because the KKZ-index and GDP per capita are representing the same phenomena and are significantly correlated with each other, both variables are not included in the regression equations simultaneously for the purpose of avoiding multicollinearity. Similar to GDP per capita, KKZ - index has a significantly negative coefficient as well, and the coefficient for *Activity Restriction* remains positive and significant.

High real GDP growth in previous years helps to reduce the level of non-performing loans, entering with a significant negative coefficient throughout all specifications. The significant positive coefficient of the *Currency depreciation* variable indicates that large exchange rate depreciations weaken the balance sheets of the banks. High inflation in the previous two years has a negative, albeit insignificant, effect on the level of NPLs. The findings contradict with theory, but as Table 3 indicates, there is a statistically significantly negative relationship between inflation and GDP per capita, which might cover the true correlation. Inflation has a significant and positive effect on the level of NPLs when plotted individually in the regression specification. Change in real interest rates has a positive impact on the level of NPLs, but the relationship is insignificant. The volatility of GDP growth has an insignificant effect on the level of NPLs.

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[17] Barth, Caprio and Levine (2001 and 2004), Beck, Demirgüc-Kunt and Levine (2006), Laeven and Levine (2006), Schaeck, Čihák and Wolfe (2006)

Table 5a: Baseline regressions of Activity Restriction variable on NPLs

The table reports OLS regression coefficients with corresponding heteroskedasticity-consistent and first-order autocorrelation corrected Newey-West standard errors (in parentheses under each coefficient) where the independent variable of interest in every specification is *Activity Restriction* variable, which measures the extent to which national banking regulations permit commercial banks to engage in other forms of activities than the traditional interest-based functions. The variable is constructed based on the survey done by Barth, Caprio and Levine in 2001 and it depicts the regulatory situation around year 1998 - 1999, with larger values indicating more restrictions. The dependent variable is the ratio of non-performing loans to total loans for a particular country for the period of 1998 – 2007. *Per Capita GDP* measures the institutional quality of a given country with higher values indicating better institutions, and the variable is calculated with a two year lag. *Real GDP growth, Currency depreciation* (the rate of change of the national currency against the US dollar, with positive values indicating depreciation), *Inflation* (rate of change of the GDP deflator) and *Real interest rate change* are aimed at controlling for the effects of macroeconomic shocks, all of which are calculated as the rate of change during the previous two years. *GDP volatility* is the standard deviation for the GDP growth during the sample period. Moving from specification (1) to (7), an additional independent control variable is plotted into the regression. From specifications (8) to (10), *KKZ – index* is plotted as an alternative proxy for institutional quality measuring the institutional situation in year 2000 with higher values indicating better institutions. For each coefficient, ***, **, and * indicate that the coefficient is different from zero at the 1%, 5% and 10%-levels, respectively. Table also reports the R-square and the number of observations for each specification.

	Dependent variable: Ratio of non-performing loans to total loans									
Independent variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Activity Restriction	***0.0125	***0.0056	***0.0060	***0.0056	***0.0057	***0.0056	***0.0055	***0.0046	***0 .0048	**0.0039
	(0.0017)	(0.0016)	(0.0015)	(0.0014)	(0.0015)	(0.0015)	(0.0015)	(0.0016)	(0.0015)	(0.0015)
Per Capita GDP		***-3.50e-06	***-3.86e-06	***-3.56e-06	-3.55e-06	***-3.53e-06	***-3.61e-06			
		(3.33e-07)	(3.64e-07)	(3.60e-07)	(3.60e-07)	(3.72e-07)	(4.16e-07)			
Real GDP growth			***-0.2844	***-0.2386	***-0.2360	***-0.2332	***-0.2292		***-0.2234	***-0.2085
			(0.0621)	(0.0615)	(0.0615)	(0.0617)	(0.0627)		(0.0628)	(.0626)
Currency depreciation				***0.0528	***0.0597	***0.05940	***0.0609		***0.0518	***0.0693
				(0.0156)	(0.0171)	(0.0172)	(0.0167)		(0.0167)	(0.0167)
Inflation					-0.0038	-0.0035	-0.0033			-0.0080
					(0.0054)	(0.0054)	(0.0054)			(0.0077)
Real interest rate change						0.0030	0.0031			0.0031
						(0.0041)	(0.0042)			(0.0056)
GDP volatility							-0.1587			*-0.5018
							(0.2469)			(0.2727)
KKZ - index								***-0.0438	***-0.0437	***-0.0495
								(0.0045)	(0.0045)	(0.0056)
Observations	613	613	609	609	609	598	598	613	609	598
R - square	0.14	0.31	0.36	0.37	0.38	0.37	0.37	0.32	0.37	0.38

Table 5b: Baseline regressions of Activity Restriction variable on NPLs

The table reports OLS regression coefficients with corresponding heteroskedasticity-consistent and first-order autocorrelation corrected Newey-West standard errors (in parentheses under each coefficient) where the independent variable of interest in every specification is *Activity Restriction* variable, which measures the extent to which national banking regulations permit commercial banks to engage in other forms of activities than the traditional interest-based functions. The variable depicts the regulatory situation around year 1998 - 1999. The dependent variable is the level of non-performing loans to total loans for a particular country for the period of 1998 – 2007. There are 80 countries in the sample *Per Capita GDP*, *Real GDP Growth* and *Currency Depreciation* are control variables in every specification, because they were found to have significant explanatory power as shown in Table 5a. These variables are calculated in the similar manner as in Table5a. *Government* and *Foreign ownership* measures the fraction of the banking system's assets that are 50% or more government and foreign owned, respectively. *Private Credit to GDP, Stock Market Cap to GDP* and *Bank Concentration* (which equals the fraction of bank assets held by the three largest commercial banks as a share of all assets) variables are all measured with a two year lag. Insurance Deposit Scheme takes the value of 1 if the country has an explicit insurance deposit scheme and 0 otherwise. Moving from specification (1) to (6) the six additional control variables are plotted individually in the regression, and in specification (7) all are plotted simultaneously. For each coefficient, ***, **, and * indicate that the coefficient is different from zero at the 1%, 5% and 10%-levels, respectively. Table also reports the R-square and the number of observations for every specification.

	Dependent variable: Ratio of non-performing loans to total loans						
Independent variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Activity Restriction	***0.0046	***0.0046	***0.0052	***0.0061	***0.0056	***0.0057	***0.0046
	(0.0013)	(0.0014)	(0.0015)	(0.0015)	(0.0015)	(0.0015)	(0.0016)
Per Capita GDP	***-3.35e-06	***-3.86e-06	***-4.21e-06	***-3.61e-06	***-3.55e-06	***-3.55e-06	***-3.91e-06
	(3.71e-07)	(4.54e-07)	(5.11e-07)	(4.32e-07)	(3.61e-07)	(3.59e-07)	(5.75e-07)
Real GDP growth	***-0.2542	***-0.2358	***-0.2275	***-0.2067	***-0.2392	***-0.2381	***-0.2017
	(0.0603)	(0.0599)	(0.0588)	(0.0626)	(0.0618)	(0.0615)	(0.0583)
Currency depreciation	**0.0414	***0.0439	***0.0580	***0.0628	***0.0525	***0.0527	***0.0563
	(0.0168)	(0.0165)	(0.0156)	(0.0166)	(0.0156)	(0.0155)	(0.0186)
Government ownership	**0.0555						***0.0693
	(0.0220)						(0.0252)
Foreign ownership		**-0.0326					-0.0109
		(0.0128)					(0.0140)
Private credit to GDP			**0.0002				***0.0002
			(9.08e-05)				(0.0001)
Stock Market Cap to GDP				0.0017			-0.0065
				(0.0062)			(0.0073)
Bank concentration					-0.0137		0.0124
					(0.0138)		(0.0175)
Insurance deposit scheme						0.0015	0.0089
						(0.0085)	(0.0089)
Observations	609	609	604	584	605	609	576
R - square	0.39	0.39	0.38	0.39	0.37	0.37	0.43

I also investigate the relationship between the *Activity Restriction* variable and the level of NPLs while controlling for the cross-country differences in the characteristics of the financial system. These results are presented in Table 5b. The additional control variables included are the percentage of government and foreign ownership of the national bank assets, domestic private credit to the private sector per GDP, stock market capitalization per GDP, banking sector concentration and whether or not the national banking system has an explicit deposit insurance scheme. The intuition for these control variables are highlighted in Section 4. *Activity Restriction*, *Per capita GDP*, *Real GDP growth* and *Currency depreciation* are the explanatory variables in every specification presented in Table 5b, because of their significant explanatory power uncovered in Table 5a. In the first six columns of Table 5b, the financial system variables are added separately in the regression, and in the seventh column all of the additional control variables are plotted simultaneously.

As Table 5b demonstrates, *Activity Restriction* variable maintains its positive and significant coefficient even after additional financial system variables are included in the regression model. Of the new control variables, *Government ownership* has a positive coefficient which is significant at 5%-level. The results give some indication, in line with previous studies, that excessive government involvement in the banking sector tends to make the whole industry inefficient and fragile. Also consistent with previous research, *Foreign ownership* has a significantly negative effect on the level of NPLs. However, the significance of the *Foreign ownership's* coefficient breaks down when all of the six new control variables are plotted simultaneously in the regression model. The level of domestic private credit to GDP lagged by two years has a positive and significant coefficient, supporting the theory which argues that banking sector problems are preceded by a period of strong credit growth. The coefficients for the rest of the control variables remain insignificant in all specifications. Worth to note is that banking sector concentration has no explanatory power what so ever on the level of non-performing loans when all other factors are controlled for.

The empirical findings show, consistent with previous research, that strict national banking regulations restricting banks' abilities to engage in different forms of activities create higher levels of non-performing loans. The results remain robust even when cross-country differences in institutional quality, macroeconomic environment and the characteristics of the financial system are controlled for. The results lend support for the first hypotheses of this

thesis, which argues that restrictions on bank activities will impede intra-industry competition in the banking sector making it more fragile.

7.1.2 Foreign Bank Discrimination

Table 6 presents the results for the regressions when the independent variable of interest is *Foreign Bank Discrimination* variable, which measures the extent to which national banking authorities discriminate foreign banks by imposing excessive entry and operational restrictions. Similar specifications and the same set of regressions are performed with the *Foreign Bank Discrimination* variable as with the *Activity Restriction* variable in Section 7.1.1. Tables 6a and 6b show that *Foreign Bank Discrimination* variable has a significant and positive coefficient in all of the regression models; the coefficient is significant at 1%-level even after controlling for a host of macroeconomic and institutional factors. The findings indicate that regulatory barriers, which hinder foreign bank entry and their ability to operate in the domestic banking market, produce higher levels of NPLs in the banking system making it more vulnerable to external shocks. The results are consistent with the second hypotheses of this thesis.

The signs and the significance of the coefficients of *KKZ - index, Per Capita GDP, Real GDP growth and Currency depreciation* remain the same as in Section 7.1.1, with inflation and GDP volatility staying insignificant. Contrary to Section 7.1.1, the change in real interest rates has a significant positive effect on the level of NPLs, just as theory predicts. Of the six financial system variables, only the coefficient for the ratio of private credit to GDP stays significant with a positive sign. Interestingly, the coefficient for *Foreign ownership* becomes insignificant when *Foreign Bank Discrimination* variable is plotted as one of the explanatory variables. The results seem to indicate that it is not the actual presence of foreign banks that matter for banking sector stability, but it is the possibility and the ease of foreign bank entry that is important. The findings show that regulations limiting the entry and the operations of foreign banks create greater fragility in the banking sector. These regulatory restrictions seem reduce the contestability of the banking sector and thus increases the level of non-performing loans. The positive relationship between *Foreign Bank Discrimination* and banking sector fragility is robust even when a host of control variables is controlled for.

Table 6a: Baseline regressions of Foreign Bank Discrimination variable on NPLs

The table reports OLS regression coefficients with corresponding heteroskedasticity-consistent and first-order autocorrelation corrected Newey-West standard errors (in parentheses under each coefficient) where the independent variable of interest in every specification is *Foreign Bank Discrimination* variable, which measures the extent to which national banking authorities discriminate foreign banks by imposing excessive entry and operational restrictions. The variable is constructed based on the survey done by Barth, Marchetti, Nolle and Sawangngoenyuang (2007) depicting the regulatory situation after 1997, with larger values indicating more restrictions and discrimination. The dependent variable is the ratio of non-performing loans to total loans for a particular country for the period of 1998 – 2007. *Per Capita GDP* measures the institutional quality of a given country with higher values indicating better institutions, and the variable is calculated with a two year lag. *Real GDP growth, Currency depreciation* (the rate of change of the national currency against the US dollar, with positive values indicating depreciation), *Inflation* (rate of change of the GDP deflator) and *Real interest rate change* are aimed at controlling for the effects of macroeconomic shocks, all of which are calculated as the rate of change during the previous two years. *GDP volatility* is the standard deviation for the GDP growth during the sample period. Moving from specification (1) to (7), an additional independent control variable is plotted into the regression. From specifications (8) to (10), *KKZ – index* is plotted as an alternative proxy for institutional quality measuring the institutional situation in year 2000 with higher values indicating better institutions. For each coefficient, ***, **, and * indicate that the coefficient is different from zero at the 1%, 5% and 10%-levels, respectively. Table also reports the R-square and the number of observations for each specification.

	Dependent variable: Ratio of non-performing loans to total loans									
Independent variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Foreign Bank Discrimination	***0.2325	***0.1417	***0.1522	***0.1557	***0.1559	***0 .1415	***0.1415	***0.1219	***0.1295	***0.1266
	(0.0352)	(0.0342)	(0.0318)	(0.0304)	(0.0305)	(0.0301)	(0.0302)	(0.0337)	(0.0296)	(0.0303)
Per Capita GDP		***-3.06e-06	***-3.31e-06	***-2.91e-06	*** -2.91e-06	***-3.00e-06	***-3.00e-06			
		(2.77e-07)	(2.86e-07)	(2.77e-07)	(2.80e-07)	(2.82e-07)	(3.00e-07)			
Real GDP growth			***-0.2895	***-0.2425	***-0.2424	***-0.2494	***-0.2492		***-0.2284	***-0.2198
			(0.0559)	(0.0557)	(0.0558)	(0.0573)	(0.0600)		(0.0558)	(0.0586)
Currency depreciation				***0.0653	***0.0632	***0.0622	***0.0623		***0.0672	***0.0697
				(0.0150)	(0.0161)	(0.0161)	(0.0161)		(0.0139)	(0.0140)
Inflation					0.0022	0.0023	0.0023			0.0010
					(0.0059)	(0.0060)	(0.0060)			(0.0070)
Real interest rate change						**0.0099	**0.0099		***0.009	***0.0100
						(0.0038)	(0.0038)		(0.0035)	(.0034)
GDP volatility							-0.0076			-0.2779
							(0.2147)			(0.2467)
KKZ - index								***-0.0428	***-0.0405	***-0.0425
								(0.0037)	(0.0035)	(0.0040)
Observations	652	652	648	648	648	633	633	652	633	633
R - square	0.13	0.32	0.38	0.41	0.41	0.42	0.42	0.36	0.45	0.45

Table 6b: Baseline regressions of Foreign Bank Discrimination variable on NPLs

The table reports OLS regression coefficients with corresponding heteroskedasticity-consistent and first-order autocorrelation corrected Newey-West standard errors (in parentheses under each coefficient) where the independent variable of interest in every specification is *Foreign Bank Discrimination* variable, which measures the extent to which national banking authorities discriminate foreign banks by imposing excessive entry and operational restrictions. The variable depicts the regulatory situation after 1997, with larger values indicating more restrictions. The dependent variable is the level of non-performing loans to total loans for a particular country for the period of 1998 – 2007. There are 80 countries in the sample. *Per Capita GDP*, *Real GDP Growth*, *Currency Depreciation* and *Real interest rate change* are control variables in every specification, because they were found to have significant explanatory power as shown in Table 6a. These variables are calculated in the similar manner as in Table 6a. *Government* and *Foreign ownership* measures the fraction of the banking system's assets that are 50% or more government and foreign owned, respectively. *Private Credit to GDP, Stock Market Cap to GDP* and *Bank Concentration* (which equals the fraction of bank assets held by the three largest commercial banks as a share of all assets) variables are all measured with a two year lag. Insurance Deposit Scheme takes the value of 1 if the country has an explicit insurance deposit scheme and 0 otherwise. Moving from specification (1) to (6) the six additional control variables are plotted individually in the regression, and in specification (7) all are plotted simultaneously. For each coefficient, ***, **, and * indicate that the coefficient is different from zero at the 1%, 5% and 10%-levels, respectively. Table also reports the R-square and the number of observations for every specification.

	Dependent variable: Ratio of non-performing loans to total loans						
Independent variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Foreign Bank Discrimination	***0.1468	***0.1408	***0.1329	***0.1441	***0.1416	***0.1407	***0.1382
	(0.0303)	(0.0307)	(0.0294)	(0.0309)	(0.0298)	(0.0312)	(0.0329)
Per Capita GDP	***-2.94e-06	***-3.01e-06	***-3.44e-06	***-2.81e-06	***-3.04e-06	***-3.01e-06	***-3.26e-06
	(2.98e-07)	(3.19e-07)	(4.05e-07)	(3.29e-07)	(2.85e-07)	(2.83e-07)	(4.58e-07)
Real GDP growth	***-0.2413	***-0.2396	***-0.2441	***-0.2280	***-0.2497	***-0.2495	***-0.2092
	(0.05821)	(0.05781)	(0.0562)	(0.0594)	(0.0575)	(0.0572)	(0.0580)
Currency depreciation	***0.0699	***0.0663	***0.0658	***0.0719	***0.0659	***0.0645	***0.0761
	(0.0149)	(0.0148)	(0.0153)	(0.0150)	(0.0153)	(0.0150)	(0.0162)
Real interest rate change	***0.0100	***0.0103	***0.0103	**0.0114	**0.0108	***0.0099	***0.0121
	(0.0038)	(0.0038)	(0.0038)	(0.0045)	(0.0044)	(0.0038)	(0.0046)
Government ownership	-0.0044						0.0019
	(0.0196)						(0.0216)
Foreign ownership		-0.0089					-0.0051
		(0.0101)					(0.0122)
Private credit to GDP			*0.0001				**0.0002
			(0.0001)				(0.0001)
Stock Market Cap to GDP				-0.001			-0.0084
				(0.0033)			(0.0047)
Bank concentration					0.0063		0.0126
					(0.0129)		(0.0155)
Insurance deposit scheme						-0.0008	0.0024
						(0.0069)	(0.0074)
Observations	625	625	628	606	628	633	597
R - square	0.42	0.42	0.42	0.41	0.42	0.42	0.42

7.1.3 Entry Requirements

In this subsection I investigate how the amount of information required from new banks entering the market affects the level of NPLs. The independent variable of interest is the *Entry Requirements* variable, with higher values indicating more regulatory impediments for new bank entry. The same set of regressions is performed for the *Entry Requirements* variable as in the previous two subsections. The results are presented in Table 7. The table shows that *Entry Requirements* does not have a significant effect on the level of non-performing loans in the economy. The relationship is insignificant when the variable is the sole explanatory variable in the regression model, and its coefficient changes from negative to positive depending on what other explanatory variables are inserted. Table 7 does not report the results of all of the regressions I have performed, but the omitted results also show that the relationship is insignificant. The empirical findings suggest that the amount of existing regulatory requirements for the entry of new banks does not have an effect on the level of NPLs, and show that the third hypothesis of my thesis does not hold. The results can be interpreted either as suggesting that the amount of entry requirements does not matter for the fragility of the banking sector or that *Entry Requirements* variable is an insufficient measure for barriers to entry for new banks. My results contradict with the findings of Barth, Caprio Levine (2004), who found a significantly positive effect, but who used a much smaller sample.

7.2 Regressions excluding crisis countries

Countries experiencing a banking crisis are usually at an abnormal state during and after the crises episodes, they might, for example, have extraordinary high levels of non-performing loans. Therefore, it would be prudent to exclude these "outliers" in the regressions to capture the effects when everything is operating as "normal". In addition, there is another advantage in excluding crisis countries. It is difficult to estimate when exactly a particular banking regulation, which has in principle come into effect, starts to have a real tangible impact on the behavior of banks. Hence, it would be sensible to perform regressions using regulatory variables from different points of time and not only the value from the beginning of the sample period, as is done in the baseline regressions. However, countries experiencing severe banking crises have a tendency to implement much more drastic changes in their regulatory

environment as compared to non-crisis countries. When these crisis countries are excluded from the sample, it would be safer to use also regulatory variables that are not solely from the beginning of the sample period, due to causality issues elaborated in Section 5.

Table 7: Baseline regressions of Entry Requirements variable on NPLs

The table reports OLS regression coefficients with corresponding heteroskedasticity-consistent and first-order autocorrelation corrected Newey-West standard errors (in parentheses under each coefficient) where the independent variable of interest in every specification is *Entry Requirements* variable, which measures the amount of existing regulatory barriers and obstacles hindering the entry of new banks. The variable is constructed based on the survey done by Barth, Caprio and Levine in 2001 depicting the regulatory situation around year 1998 - 1999, with larger values indicating more barriers. The dependent variable is the level of non-performing loans to total loans for a particular country for the period of 1998 – 2007. There are 80 countries in the sample. Moving from specification (1) to (4), additional independent control variables are plotted into the regression. These control variables were found to have significant explanatory power on the level of NPLs, as demonstrated in Table 5 and Table 6. *Per Capita GDP* is the proxy for the institutional quality and is measured with a two year lag. *KKZ – index* is plotted as an alternative proxy for institutional quality measuring the institutional situation in year 2000, with higher values indicating better institutions. *Real GDP growth, Currency depreciation* (the rate of change of the national currency against the US dollar, with positive values indicating depreciation) and *Real interest rate change* are all calculated as the rate of change for the previous two years. *Government ownership* measures the fraction of the banking system's assets that are 50% or more government owned. *Private Credit to GDP* variable is measured with a two year lag. For each coefficient, ***, **, and * indicate that the coefficient is different from zero at the 1%, 5% and 10%-levels, respectively. Table also reports the R-square and the number of observations for each specification.

	Dependent variable: Ratio of non-performing loans to total loans			
Independent variables	(1)	(2)	(3)	(4)
Entry Requirements	0.0023	-*0.0039	-0.0013	0.0016
	(0.0028)	(0.0022)	(0.0027)	(0.0024)
KKZ - index		***-0.0508		
		(0.0045)		
GDP per capita			***-4.06e-06	***-4.39e-06
			(3.74e-07)	(4.89e-07)
Real GDP growth			***-0.2285	***-0.2331
			(0.0617)	(0.0575)
Currency depreciation			***0.0574	***0.0480
			(0.0160)	(0.0171)
Real interest rate change			0.0037	0.0046
			(0.0038)	(0.0044)
Government Ownership				***0.0709
				(0.0232)
Private credit to GDP				***0.0002
				(0.0001)
Observations	613	613	598	593
R - square	0.00	0.31	0.35	0.39

Table 8 presents the regression results when countries[18] that have experienced banking crises during the sample period of 1998 – 2007 are excluded. The data on whether a country has experienced banking crises is obtained from the database constructed by Caprio and Klingebiel (2003) and there are 15 countries excluded from the sample. The countries that have suffered from the recent credit crises and the resulting bank distress are not excluded.

[18] Argentina (2001 –), Brazil (1994 – 1999), Ecuador (1996 – 2001), Indonesia (1997 – 2002), Korea (1997 – 2002), Malaysia (1997 – 2001), Mexico (1994 – 2000), Paraguay (1995 – 2000), Philippines (1998 –), Russia (1998 – 1999), Thailand (1997 – 2002), Turkey (2000 –), Ukraine (1997 – 1998), Uruguay (2002 –)

There is not yet sufficient information available to classify exactly, which countries are in a crisis at the moment. However, the sample data shows that the effect of the credit crisis has not yet manifested itself as a extreme growth in the level of NPL during the years 2006 and 2007 for the US and UK, for example. When more data are available in the future, it would be of great interest to study the roles of banking regulations and regulatory changes as a cause of the recent credit crunch.

For both *Activity Restriction* and *Entry Requirements* variables there are three different values available, depicting the regulatory situation at three different points of time; the three values are from the years 1999, 2002 and 2006 which are conveniently from the beginning, the middle and the end of the sample period. All of the three values for both of the two regulatory variables are plotted as explanatory variables to see if the findings are consistent with those uncovered in Section 7.1. Unfortunately, for *Foreign Bank Discrimination* there is only one value available, so this sort of analysis is not possible. In all of the regressions performed in Table 8, the dependent variable used is the level of NPLs. Furthermore, besides each of the independent banking regulatory variables of interest, every regression model includes *GDP per capita, GDP growth, Currency depreciation, Real interest rate change, Government ownership and Private Credit to GDP* as control variables. These variables have significant explanatory power on the level of NPLs as demonstrated in Section 7.1.

As Table 8 demonstrates, the sign and significance of the coefficients for the *Foreign Bank Discrimination* variable and the year 1999 values of the *Activity Restriction* and *Entry Requirements* variables stay the same as in the baseline regressions: both *Foreign Bank Discrimination* and *Activity Restriction* variables have significantly positive coefficients and *Entry Requirements* has an insignificant coefficient. These regressions are similar to those baseline regressions performed in Section 7.1 with the exception of excluding crisis countries. When the year 2002 values, namely from the middle of the sample period, for the *Activity Restriction* and *Entry Requirements* are plotted, the results differ. The coefficient for the *Entry Requirements* stays insignificant, but the coefficient for the *Activity Restriction* variable becomes negative, albeit insignificant. The results change even more when the year 2006 values are plotted. The coefficient for the *Activity Restriction* stays insignificant, but the coefficient for the year 2006 value of the *Entry Requirements* variable becomes significantly positive at 1%-level.

Table 8: Regressions of the three banking regulation variables excluding crisis countries

The table reports OLS regression coefficients with corresponding Newey-West standard errors (in parentheses under each coefficient) where the independent variables of interest are the three competition regulation variables: (1) *Activity Restriction* measuring the extent to which national banking regulations permit commercial banks to engage in other forms of activity than the traditional interest-based functions, (2) *Entry Requirements* measuring the amount of existing regulatory barriers and obstacles hindering the entry of new banks, (3) *Foreign Bank Discrimination* measuring the extent to which national banking authorities discriminate foreign banks by imposing excessive entry and operational restrictions. For all three variables, larger values indicate more restrictions and requirements. There are three different values for *Activity Restriction* and *Entry Requirements* variables depicting the regulatory situation at different periods of time; the signs *Beginning, Middle and End* behind each variable mean that they represent the situation around year 1999, 2002 and 2006. The dependent variable is the level of NPLs for the period of 1998 – 2007 and countries that have experienced a banking crisis during this period are excluded from the sample (15 countries). There are 65 countries in the sample. The regression model in every specification is in the form of $NPL = \alpha + \beta_1 GDP\_Per\_Capita + \beta_2 GDP\_Growth + \beta_3 Currency\_Depreciation + \beta_4 Real\_Interest\_Rate\_Change + \beta_5 Government\_Ownership + \beta_6\ Private\_Credit\_to\_GDP + \beta_7 Banking\_Regulation\_Variable + \varepsilon$, where the *Banking_Regulation* variable is the corresponding independent variable in the left column. For each coefficient, ***, **, and * indicate that the coefficient is different from zero at the 1%, 5% and 10%-levels, respectively. Table also reports the R-square and the number of observations for each specification.

	Dependent variable: Ratio of non-performing loans to total loans						
Independent variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) Activity Restriction: Beginning	***0.0044						
	(0.0011)						
(2) Activity Restriction: Middle		-0.0012					
		(0.0014)					
(3) Activity Restriction: End			0.0019				
			(0.0014)				
(4) Entry Requirements: Beginning				0.0032			
				(0.0022)			
(5) Entry Requirements: Middle					0.0042		
					(0.0030)		
(6) Entry Requirements: End						***0.0123	
						(0.0029)	
(7) Foreign Bank Discrimination							***0.1433
							(0.0352)
Observations	493	534	542	493	534	562	513
R - square	0.41	0.38	0.40	0.40	0.38	0.40	0.43

The findings show that the choice of the regulatory variable from different periods significantly alters the results. Only a three year difference, from 1999 to 2002, in the value of the *Activity Restriction* can change the effect of the regulation from extreme significance to insignificant. Similarly with *Entry Requirements*, a four year difference, from 2002 to 2006, can cause the variable's coefficient to become highly significant. The findings indicate that the choice of sample period could have a considerable impact on the results, and that the relationship uncovered in the previous section and by earlier studies might not be robust when the sample period is altered. Next, I investigate the relationship further dividing the sample period into different sub-samples.

7.3 Dividing the sample period

In this subsection I divide the main sample period into two sub-samples, the first covering the period of 1998 – 2002 (A – sample), and the second covering the period of 2003 – 2007 (B – sample). The results for these regressions are presented in Table 9. The effects of the bank regulations are examined by using their values both at the beginning and at the end of the sub-samples. For A – sample, the regulatory situation at the beginning of the sample period is depicted by the regulation's value in year 1999, and the situation at the end of the period is depicted by the value in 2002. For the B - sample, the regulatory situation at the beginning and at the end of the sub-sample period are depicted by the values in year 2002 and 2006, respectively. Similarly with previous specifications, macroeconomic, financial system and institutional effects are controlled for in every regression. Crisis countries are excluded from the regression.

As Table 9 demonstrates, the *Foreign Bank Discrimination* variable has a significant positive coefficient in both of the sub-samples, indicating that the effect of the variable is irrespective to the choice of the sample period. The results would be more accurate, if time-series values for the *Foreign Bank Discrimination* variable could be obtained. As for the other regulatory variables, Table 9 shows that only the value of the *Activity Restriction* variable at the beginning of sample period of 1998 – 2002 has a significant explanatory power on the level of non-performing loans. Neither does its value at the beginning nor at the end of the sub-sample period of 2003 – 2007 have any significance. The coefficient for the *Entry Requirements* variable becomes more significant when the sample period is divided; the variable's

coefficient is positive and significant at 10%-level at the beginning of both of the sub-sample periods, and is significant at 1%-level for its value at the end of the B-sample period.

The findings in this subsection give clearly indicate that the effect of the *Foreign Bank Discrimination* variable is robust to modifications in the sample period, further validating the second hypotheses. However, the effects of the *Activity Restriction* and *Entry Requirements* variables do not stay consistent, and there is convincing evidence that the results depend on the choice of the sample period. The year 1999 value of the *Activity Restriction* variable has a significant explanatory power on the level of NPLs, but when the 2002 and 2006 values are used the significance breaks down. The huge differences between the significances of the 1999 and the 2002 values can be explained by examining more closely the data of the changes in the regulatory changes.

Countries with have high levels of are more inclined to free their activity restrictions. For example Egypt, whose average level of non-performing loans is 21% for the ten year sample period, had a change of -3 in the Activity Restriction variable between 1999 and 2002. In addition, Morocco whose average level of non-performing loans is 16% had a change of -3 in its activity restrictions and Ghana, with an average of 16%, implemented a change of -3 in its regulations. On the other hand, countries with low levels of NPLs have the tendency to tighten their restrictions. For example, Australia, with an average of 0.4%, had a change of +3, Austria with a 2.5% average had a change of +2, and Switzerland with a 2.3% average had a change of +2. Apparently, even though crisis countries have a greater propensity to tighten their activity restrictions, as demonstrated in Section 5, there is a more general trend for countries with high levels of NPLs to free their restrictions. On the other hand, countries with lower levels of NPLs are more apt to impose stricter restrictions. For example, 11 high income countries tightened their activity restrictions as opposed to 7 high income countries[19] that actually freed restrictions.

Countries, with high levels of non-performing loans throughout the sample period, had strict activity restrictions at the beginning of the sample period, in year 1999. This explains why the year 1999 value of the *Activity Restriction* variable had such a prevailing significance in the regressions. However, these countries also had the tendency to liberate their activity

[19] The United States had a change of -2 in securities activities with the repeal of the Glass-Steagall Act.

Table 9: Regressions when the sample period is divided

The table reports OLS regression coefficients with corresponding Newey-West standard errors (in parentheses under each coefficient) where the independent variables of interest are the three competition regulation variables: (1) *Activity Restriction* measuring the extent to which national banking regulations permit commercial banks to engage in other forms of activity than the traditional interest-based functions, (2) *Entry Requirements* measuring the amount of existing regulatory barriers and obstacles hindering the entry of new banks, (3) *Foreign Bank Discrimination* measuring the extent to which national banking authorities discriminate foreign banks by imposing excessive regulatory entry and operational restrictions. For all three variables, larger values indicate more restriction and requirements. The dependent variable is the level NPLs. The regressions are run by dividing the main sample, which covers the period 1998 – 2007, into two subsamples: the first sub-sample covers the period of 1998 – 2002 (specifications with the label A) and the second covers the period of 2003 - 2007 (specifications with the label B). Countries that have experienced a banking crisis during this period are excluded from the sample. For both of the two sub-samples there are two different values for the *Activity Restr*iction and *Entry Requirements* variables, each of which depicts the regulatory situation both at the beginning and at the end of the sub-sample periods. For the first sub-sample (A) the signs *Beginning and End* mean that the regulatory variable depicts the regulatory situation in year 1999 and 2002, respectively. For the second sub-sample (B) the signs *Beginning and End* mean that the variable depicts the situation around year 2002 and 2006, respectively. The regression model in every specification is in the form of $NPL = \alpha + \beta_1 GDP\_Per\_Capita + \beta_2 GDP\_Growth + \beta_3 Currency\_Depreciation + \beta_4 Real\_Interest\_Rate\_Change + \beta_5 Government\_Ownership + \beta_6 Private\_Credit\_to\_GDP + \beta_7 Banking\_Regulation\_Variable + \varepsilon$, where the *Banking_Regulation* variable is the corresponding independent variable in the left column. For each coefficient, ***, **, and * indicate that the coefficient is different from zero at the 1%, 5% and 10%-levels, respectively. Table also reports the R-square and the number of observations for each specification.

	Non-performing loans: 1998 - 2002					Non-performing loans: 2003 - 2007				
Independent variables	**A(1)**	**A(2)**	**A(3)**	**A(4)**	**A(5)**	**B(1)**	**B(2)**	**B(3)**	**B(4)**	**B(5)**
(1) Activity Restriction: Beginning	***0.0045					-0.0023				
	(0.0017)					(.00018)				
(2) Activity Restriction: End		0.0010					0.00003			
		(0.0022)					(0.0018)			
(3) Entry Requirements: Beginning			*0.0063					*0.0062		
			(0.0034)					(0.0033)		
(4) Entry Requirements: End				0.0018					***0.0125	
				(0.0050)					(0.0033)	
(5) Foreign Bank Discrimination					***0.1805					***0.1241
					(0.0448)					(0.0481)
Observations	241	262	241	262	253	272	277	272	287	260
R - square	0.43	0.37	0.43	0.37	0.44	0.38	0.42	0.38	0.42	0.42

restrictions afterwards, thus having a lower value for the activity restriction variable in year 2002 and 2006. Consequently, these low values cannot then explain the high levels of non-performing loans throughout the sample period when they are plotted in the regression model as explanatory variables. The similar phenomenon is at work for countries with low levels of NPLs. They have loose activity restrictions at the beginning of the sample period, which correlates robustly with the low levels of NPLs, but when the activity restrictions are tightened afterwards, this relationship breaks down.

Barth, Caprio and Levine (2004) and Beck, Demirgüc-Kunt and Levine (2006) use the 1999 values of the Activity Restriction variable in their studies, which explains why they discover a significant and positive relationship between strict activity regulations and banking distress. The findings of this thesis provide convincing evidence against the discoveries of these previous studies. However, the conclusions of Barth et al. could be justified if it is assumed that even if bank regulations change in the books, the new regulations' real effect do not necessarily take place instantaneously, and it is the regulatory values at the beginning that still governs the whole sample period. However, because of the length of the sample period, covering a decade, this assumption is not necessarily valid. Therefore in the next subsection, I perform regressions where countries that have had large regulatory changes are excluded from the sample.

7.4 Excluding countries with changes in regulations

In this subsection, I perform regression where countries that have implemented large changes in their regulatory variables are excluded from the regression samples. Because it is difficult to assess when the effects of the new regulations really take place, it would be prudent to use countries that have not had changes, or at least only small changes, in their regulatory framework. If there have been no adjustments in the regulatory environment, there should be no difficulties in indentifying the effects of regulations in different periods of time. Table 10 reports the results for the regressions where countries with large regulatory changes are excluded from the sample. In the specifications with the capital letter **A**, countries that have had large changes in the *Activity Restriction* variable are excluded from the sample. Because only 11 countries have had zero changes in their *Activity Restriction* variable, and thus the

sample size is too small, I also perform regressions where countries, which have had only small changes in their activity regulations, are included in the sample. The notations [0,0], [-1,1] and [-2,2] on top of every specifications means that countries with changes not larger than 0, 1 and 2 in their *Activity Restriction* variable are included in the regression. In the specifications with the capital letter **E,** countries with large changes in the *Entry Requirements* variable are excluded from the regression. The meanings for the notations [0,0], [-1,1] and [-2,2] are similar to those described previously. The changes are calculated as the difference in the regulatory values between 1999 and 2002. The year 1999 value of the *Activity Restriction* variable is plotted as the explanatory variable for the A specifications, whereas the year 1999 value of the *Entry Requirements* variable is plotted as the explanatory variable for the **E** specifications, while controlling for the macroeconomic and institutional factors.

Table 10: Regressions excluding countries with large regulatory changes

The table reports OLS regression coefficients with corresponding Newey-West standard errors (in parentheses under each coefficient) where the independent variables of interest are the three regulation variables: (1) *Activity Restriction* (2) *Entry Requirements* (3) *Foreign Bank Discrimination*, with larger values indicating more restriction. The dependent variable is the level of NPLs for the period of 1998 – 2007. Countries that have experienced a banking crisis during the period and that have changed their banking regulatory variables significantly are excluded from the sample. In the specifications with the capital letter **A**, countries that have had large changes in the *Activity Restriction* variable are excluded from the sample. The notations [0,0], [-1,1] and [-2,2] on top of every specifications means that countries with changes not larger than 0, 1 and 2 in the *Activity Restriction* variable are included in the regression. In the specifications with the capital letter **E,** countries with large changes in the *Entry Requirements* variable are excluded. The meanings for the notations [0,0], [-1,1] and [-2,2] are similar to those described previously. The changes are calculated as the difference in the regulatory values between 1999 and 2002. The regression model in every specification is in the form of $NPL = \alpha + \beta_1 KKZ\_index + \beta_2 GDP\_Growth + \beta_3 Currency\_Depreciation + \beta_4 Real\_Interest\_Rate\_Change + \beta_5 Private\_Credit\_to\_GDP + \beta_6 Banking\_Regulation\_Variable + \varepsilon$, where the *Banking_Regulation* variable is the corresponding independent variable in the left column. For each coefficient, ***, **, and * indicate that the coefficient is different from zero at the 1%, 5% and 10%-levels, respectively. Table also reports the number of countries for each specification.

	A: Changes in Activity Restriction			**E**: Changes in Entry Requirements		
Independent variable	**A**[0 , 0]	**A**[-1 , 1]	**A**[-2 , 2]	**E**[0 , 0]	**E**[-1 , 1]	**E**[-2 , 2]
Activity Restriction	0.0010	0.0022	0.0004			
	(0..0022)	(0.0014)	(0.0011)			
Entry Requirements				-0.0040	0.0029	-0.0003
				(0.0042)	(0 .0020)	(0. 0026)
Foreign Bank Discrimination	-0.0134	***0 .4187	*** 0.1322	*0.0646	*** 0.1033	***0 .1083
	(0.0596)	(0 .1361)	(0. 0469)	(0.0354)	(0.0359)	(0. 0361)
Number of countries	11	29	43	32	46	50

As Table 10 shows, *Activity Restriction's* coefficient becomes insignificant when the countries with larger changes in their activity regulations are excluded. There are only 11 countries in the regression specification presented in the first column of the table, where only countries with zero changes are included. Hence, the insignificant relationship uncovered can be purely due to the small size of the sample. Still, when the sample size is enlarged by also

including countries that have had only small changes in their *Activity Restriction* variable, its explanatory power remains insignificant. Similarly, the coefficient for *Entry Requirements* is insignificant in all of three specifications with different sample sizes, presented in the fourth to the sixth columns.

Contrary to previous studies, the findings in this subsection do not find any significant relationship between the two banking regulatory variables and banking sector fragility. If there would be a consistent positive correlation between the two regulations and banking distress as documented before, it should be most evident among the countries whose regulatory environment has stayed relatively stable throughout the whole sample period. The findings strongly suggest that *Activity Restriction* and *Entry Requirements* variables do not have a significant impact on the level of NPLs, contrary to Hypotheses 1 and 3.

Because there is only one value available for the *Foreign Bank Discrimination* variable, it is not possible to do a similar analysis. Nonetheless, changes in different bank regulations tend to occur simultaneously; countries having drastic changes in one banking regulation most probably will implement extreme adjustments in other parts of the regulatory environment as well. Therefore changes in the other two regulatory variables could give some indication of whether there have also been changes in the regulations discriminating foreign banks. The second last row of Table 10 presents the results when the *Foreign Bank Discrimination* variable is plotted as the explanatory variable of interest in all of the six specifications. The coefficient is positive and significant at 1%-level in four specifications and at 10%-level in one specification, supporting second hypotheses of the thesis which states that regulations discriminating foreign banks cause fragility in the banking sector. The coefficient is negative, albeit insignificant, in the specification including only countries with zero changes in the *Activity Restriction* variable. However, the sample size is quite small, which might cause the insignificance.

I also investigate, whether the actual changes in the banking regulations are the factors impacting the subsequent development of non-performing loans. The findings of these regressions show that changes in neither of two regulatory variables affect the successive growth of NPLs. The findings are not reported in this thesis, but are available upon request.

7.5 Dividing countries according to income groups

In this subsection I investigate whether the effects of the banking regulatory variables is robust when the sample countries are divided into two groups according to their income level. The stringency of banking regulations can have quite a different impact on banking sector fragility depending on the country's income level and, especially, its institutional development and quality. The institutional control variables used, KKZ – index and GDP per capita, cannot necessarily capture all of the institutional effects at work. To uncover the possible impacts of these hidden factors, I divide all of the countries in the main sample into two sub-groups: (1) High income countries and (2) Middle and low income countries. Crises countries are excluded from both sub-groups. The allocation of countries into two groups is based on the definitions made by the World Bank. The first group includes 29 countries[20] and second group 36 countries. All the regressions are done in the similar manner as in the previous subsections with same specifications and the same set of control variables. The dependent variable is the level of NPLs and the sample period is 1998 – 2007. The first five columns of Table 11 present the regressions when the sample period includes only high income countries, and the last five includes only middle and low income countries.

As Table 11 demonstrates, *Foreign Bank Discrimination* variable has a significant positive effect on the level of NPLs for both high income and low income countries. An interesting finding is that the coefficient for the variable is significantly higher for the high income group than for the middle and low income group, a significance level of 1% as compared to 10%-level. This might be explained by the fact that in countries where the institutional quality is already weak and corruption high, discrimination towards foreign banks does not have that strong of an additional effect on the already high levels of non-performing loans. However, in a country with otherwise well functioning and high quality institutions and low levels of NPLs, the incremental effect of foreign bank discrimination can be quite pronounced. For the *Activity Restriction* variable, once again, only the year 1999 values have any significant explanatory power, with the 2002 and 2006 values' coefficients staying insignificant.

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[20] Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Hong Kong, Iceland, Ireland, Israel, Italy, Japan, Kuwait, Luxembourg, Netherlands, Norway, Portugal, Saudi Arabia, Singapore, Slovenia, Spain, Sweden, Switzerland, United Arab Emirates, United Kingdom, United States

Table 11: Regressions when the sample is divided according to income groups

The table reports OLS regression coefficients with corresponding Newey-West standard errors (in parentheses under each coefficient) where the independent variables of interest are the three competition regulation variables: (1) *Activity* (2) *Entry Requirements* (3) *Foreign Bank Discrimination* measuring. For all three variables, larger values indicate more restriction and requirements. There are three different values for the *Activity Restri*ction and *Entry Requirements* variables, each of which depicting the regulatory situation at different periods of time; the signs *Beginning, Middle and End* behind each variable mean that they depict the situation around year 1999, 2002 and 2006, respectively. The dependent variable is the level of non-performing loans to total loans for a particular country for the period of 1998 – 2007 and countries that have experienced a banking crisis during this period are excluded from the sample (15 countries). The regressions are run by dividing the main sample (65 countries) into two subsamples according to which income group a country belongs; 29 countries are in the *High income group* (specifications with the label H) and 36 countries are in the *Middle and low income group* (specifications with the label L). The grouping is based on the definitions done by the World Bank. The regression model in every specification is in the form of $NPL = \alpha + \beta_1 GDP\_Per\_Capita + \beta_2 GDP\_Growth + \beta_3 Currency\_Depreciation + \beta_4 Real\_Interest\_Rate\_Change + \beta_5 Government\_Ownership + \beta_6\ Private\_Credit\_to\_GDP + \beta_7 Banking\_Regulation\_Variable + \varepsilon$, where the *Banking_Regulation* variable is the corresponding independent variable in the left column. For each coefficient, ***, **, and * indicate that the coefficient is different from zero at the 1%, 5% and 10%-levels, respectively. Table also reports the R-square and the number of observations for each specification.

	High income countries							Middle and low income countries						
Independent variables	**H(1)**	**H(2)**	**H(3)**	**H(4)**	**H(5)**	**H(6)**	**H(7)**	**L(1)**	**L(2)**	**L(3)**	**L(4)**	**L(5)**	**L(6)**	**L(7)**
(1) Activity Restriction Beginning	**0 .0021							***0.0070						
	(0.0008)							(0.0026)						
(2) Activity Restriction Middle		-0.0001							-0.0009					
		(0.0010)							(0.0023)					
(3) Activity Restriction End			0.0012							0.0018				
			(0.0007)							(0.0031)				
(4) Entry Requirements Beginning				-0.0005							*0.0072			
				(0.0019)							(0.0041)			
(5) Entry Requirements Middle					-0.0040							**0.01142		
					(0.0026)							(0.0055)		
(6) Entry Requirements End						0.0020							***0.0185	
						(0.0021)							(0.0040)	
(7) Foreign Bank Discrimination							***0.1322							*0.1028
							(0.0433)							(0.0607)
Observations	232	252	252	232	252	252	252	282	282	290	261	282	310	261
R - square	0.30	0.27	0.28	0.27	0.29	0.28	0.37	0.33	0.29	0.32	0.32	0.31	0.34	0.32

Another interesting finding is that the coefficient of the *Entry Requirements* variable is significantly positive for middle and low income countries. The variable's coefficient is negative, albeit insignificant, for high income countries. It would be logical to presume that numerous entry requirements would actually be beneficial for middle and low income countries. In these countries, there would probably be more unsound and weak banks trying to enter the market. Thus, it could be expected that more restrictive entry requirements would have a negative coefficient in middle and low income countries, reducing the level of NPLs and having a beneficial effect on the stability of the banking sector. On the other hand, tight entry requirements in countries with weak institutional development could indicate that the national authorities exercise a policy that restricts competition favouring the incumbent banks. Furthermore, in countries with low income, banking regulators can use the tight entry restrictions to reward friendly constituents or to extract campaign support, letting in fragile banks and harming market stability (Djankov, La Porta, Lopez-De-Silanes and Shleifer, 2002).

7.6 Summary

The findings of this section indicate that more regulations discriminating the entry and operations of foreign banks create higher levels of non-performing loans. The results are robust when a host of macroeconomic, financial system and institutional factors are controlled for, when crisis countries and countries with large changes in their bank regulations are excluded from the sample and when the main sample is divided according to timeframe and income groups. Worth to note is that the actual presence of foreign banks does not seem to have a significant impact when the discrimination variable is entered in the regressions as an explanatory variable. Furthermore, the effect of *Foreign Bank Discrimination* variable on the level of non-performing loans is stronger for high income countries as compared to low income countries.

The results indicate that *Entry Requirements* variable do not have a notable impact on the level on non-performing loans. Its coefficient is insignificant when regressed against the whole sample period, when crisis countries and countries with large changes in their bank regulations are excluded from the sample. The regulatory variable does exhibit some significance when the sample period is divided, and the strongest effect is obtained for the

when it is regressed against the sub-sample that consists only of middle and low income countries. However, the findings in this section are not robust enough to safely accept the third hypotheses of the thesis stating that more entry requirements are harmful to the stability of the banking sector.

For the *Activity Restriction* variable, only its year 1999 value has a significant explanatory power on the level of non-performing loans, the coefficient is positive and significant in almost every specification. However, the other two values of the variable, depicting the situation at year 2002 and 2006, do not have any significance in any specification. These finding give some indication that sample choice might have a serious impact on the results uncovered. The strongest evidence against the significance of this variable are obtained, when regressions are performed where countries that have had changes in this regulation during the sample period are excluded, even the year 1999 value of the *Activity Restriction* variable becomes insignificant. The results show that activity restrictions do not have a notable impact on the level on non-performing loans and on the fragility of the banking sector. My findings also indicate that the significant relationships uncovered by previous studies could be purely due to the choice of the sample period and sample countries. Table 12 presents a summary of the findings of this section.

Table 12: Summary of findings in Section 7

Table presents a summary of the empirical findings of Section 7. The left column shows what sample is used in the regression. The top row of the table shows what regulatory variable is in question. *Positive* indicates that the coefficient of the regulatory variable is positive in that regression specification, meaning that the variable has a positive correlation with the level of non-performing loans. The values for the *Activity Restriction* and *Entry Requirements* variables are depicting the regulatory situation in year 1999. For that coefficient ***, **, and * indicate that it is different from zero at the 1%, 5% and 10%-levels, respectively. *Insignificant* indicates that the coefficient was significant at a level less than 10%.

Sample	Activity Restriction (1999)	Entry Requirements (1999)	Foreign Bank Discrimination
Baseline (1998 - 2007)	***Positive	Insignificant	***Positive
Excluding crisis countries (1997 - 2007)	***Positive	Insignificant	***Positive
Early sub-sample (1998 - 2002)	***Positive	*Positive	***Positive
Latter sub-sample (2003 - 2007)	Insignificant	*Positive	***Positive
Excluding countries with changes in regulations (1998 - 2007)	Insignificant	Insignificant	
High income countries (1998 - 2007)	**Positive	Insignificant	***Positive
Middle and low income countries (1998 - 2007)	***Positive	*Positive	*Positive

8. Robustness check

This section aims at checking the robustness of the findings uncovered in Section 7. I investigate the relationship between the banking regulation variables and bank fragility using an alternative measure for the fragility of the banking sector. The volatility of the return on the domestic banking industry stock index is used as the alternative dependent variable. Higher volatility in the stock prices of the domestic banks indicates greater uncertainty about the stability of the banking sector and the soundness of individual banks.

The stock index values of the domestic banking industry for different countries are obtained from Datastream. Both the monthly and weekly values for the banking industry index are collected and the standard deviation of the return on the index is calculated on an annual basis. The sample includes over 40 countries covering the period of 1998 – 2007. Table 13 presents the regression results when the independent variable of interest is the *Foreign Bank Discrimination*, and Table 14 present the regression results when the variables of interest are *Activity Restriction* and *Entry Requirements*. In the regression specifications, the effects of macroeconomic and institutional factors are controlled for. Stock market capitalization to GDP is included with higher values indicating more developed stock markets, which should decrease the level of volatility. Higher volatility in GDP growth, calculated for the sample period, should lead to higher volatilities in the stock market. Large currency depreciation and rampant inflation in the previous year should also contribute to higher uncertainty. Last, better institutional development, measured by KKZ – index, should reduce stock price instability.

As Table 13 demonstrates, the coefficient of the *Foreign Bank Discrimination* variable is positive and statistically significant in almost every specification, when both the weekly and monthly volatilities are used as the dependent variable. The results indicate that more discriminatory regulations result in higher volatility in the stock prices of domestic banks. The findings of the regressions using an alternative measure for banking sector fragility also indicate, that excessive regulatory discrimination of foreign bank causes more fragility and instability in the banking sector. The coefficient for the discrimination variable enters insignificantly when the KKZ – index is included in the regression. The results can be interpreted as suggesting that when the broad institutional development of the economy is

Table 13: Regression using the volatility of the banking sector stock index as the dependent variable with Foreign Bank Discrimination

The table reports OLS regression coefficients with corresponding Newey-West standard errors (in parentheses under each coefficient) where the independent variable of interest in every specification is *Foreign Bank Discrimination* variable, with larger values indicating more restrictions. The dependent variable in the specifications (1) to (6) is the monthly volatility of the return of the domestic banking sector stock price index, calculated annually covering the period of 1998 – 2007. The dependent variable in the specifications (7) to (12) is the weekly volatility of the return of the domestic banking sector stock price index, calculated annually covering the period of 1998 – 2007. The dependent variables are obtained from Datastream. There are 47 countries in the sample. *Stock Market Cap to GDP and KKZ –index* are measured with a two year lag. *Currency depreciation* (the rate of change of the national currency against the US dollar, with positive values indicating depreciation) and *Inflation* (rate of change of the GDP deflator) are calculated with a one year lag. *GDP volatility* is the standard deviation for the GDP growth during the sample period. For each coefficient, ***, **, and * indicate that the coefficient is different from zero at the 1%, 5% and 10%-levels, respectively. Table also reports the R-square and the number of observations for each specification.

	Monthly volatility						Weekly volatility					
Independent variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
Foreign Bank Discrimination	***0.0006	***0.0005	**0.0004	**0.0004	**0.0004	0.0003	***0.0002	**0.0001	*0.0001	*0.0001	**0.0001	0.0001
	(0.0002)	(0.0002)	(0.0002)	(0.0001)	(0.0001)	(0.0002)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
						-0.0063						
Stock Market Cap to GDP		***-0.0118	***-0.0111	***-0.0088	**-0.0074			***-0.0053	***-0.0051	***-0.0041	***-0.0037	**-0.0037
		(0.0036)	(0.0036)	(0.0032)	(0.0034)	(0.0038)		(0.0014)	(0.0014)	(0.0013)	(0.0014)	(0.0014)
GDP volatility			***0.5344	0.2669	0.2033	0.1535			***0.2245	0.1110	0.0906	0.0705
			(0.1812)	(0.1663)	(0.1850)	(0.2142)			(0.0776)	(0.0724)	(0.0800)	(0.0874)
Currency depreciation				***0.1555	***0.1363	***0.136				***0.066	***0.0599	***0.0599
				(0.0273)	(0.0291)	(0.0291)				(0.0098)	(0.0104)	(0.0104)
Inflation					0.0394	0.0363					0.0124	0.0112
					(0.0308)	(0.0305)					(0.0115)	(0.0118)
KKZ						-0.0026						-0.0010
						(0.0047)						(0.0018)
Observations	476	475	465	465	463	463	476	475	465	465	463	463
R - square	0.02	0.05	0.08	0.20	0.20	0.20	0.02	0.06	0.10	0.23	0.24	0.24

Table 14: Regression using the volatility of the banking sector stock index as the dependent variable with Activity Restriction and Entry Requirements variables

The table reports OLS regression coefficients with corresponding Newey-West standard errors (in parentheses under each coefficient) where the independent variables of interest are the *Activity Restriction* and *Entry Requirements*, with larger values indicating more restrictions. The dependent variable in every specification is the monthly volatility of the return of the domestic banking sector stock price index, calculated annually covering the period of 1998 – 2007. The dependent variables are obtained from Datastream. There are 47 countries in the sample. *Stock Market Cap to GDP and KKZ –index* are measured with a two year lag. *Currency depreciation* (the rate of change of the national currency against the US dollar, with positive values indicating depreciation) and *Inflation* (rate of change of the GDP deflator) are calculated with a one year lag. *GDP volatility* is the standard deviation for the GDP growth during the sample period. For each coefficient, ***, **, and * indicate that the coefficient is different from zero at the 1%, 5% and 10%-levels, respectively. Table also reports the R-square and the number of observations for each specification.

	Weekly volatility						Weekly volatility					
Independent variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Activity Restriction	***0 .0017	** 0.0012	0.0008	0.0005	0.0005	-0.0000						
	(0.0002)	(0 .0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)						
Entry Requirements							0 .0006	0 .0005	0 .0006	0 .0005	0 .0003	0 .0000
							(0.0007)	(0.0007)	(0.0007)	(0.0006)	(0.0006)	(0.0006)
Stock Market Cap to GDP		***-0.0071	**-0.0057	**-0.0088	**-0.0048	-0.0018		***-0.0082	***-0.0061	***-0.0056	***-0.0051	-0.0015
		(0.0025)	(0.0024)	(0.0022)	(0.0022)	(0.0022)		(0.0025)	(0.0023)	(0.0020)	(0.0021)	(0.0022)
GDP volatility			***0.2731	*0.1401	0.1213	0.0219			***0.2858	*0.1553	0.1192	0.0080
			(0.0875)	(0.0802)	(0.0867)	(0.0913)			(0.0902)	(0.0805)	(0.0877)	(0.0948)
Currency depreciation				***0.0772	***0.0710	***0.070				***0.0775	***0.0679	***0.0687
				(0.0102)	(0.117)	(0.0112)				(0.0114)	(0.0122)	(0.0220)
Inflation					0.0116	0.0077					0.0223	0.0123
					(0.121)	(0.0115)					(0.0142)	(0.0156)
KKZ						-0.0057						***-0.006
						(0.0024)						(0.0020)
Observations	466	465	455	455	453	453	426	426	426	426	425	425
R - square	0.04	0.07	0.11	0.28	0.28	0.28	0.00	0.04	0.10	0.26	0.27	0.29

accounted for, regulations discriminating foreign banks do not have any additional explanatory power on the volatility of stock prices of the domestic banking industry. However, the coefficient for the KKZ – index is also insignificant, so any definitive conclusions cannot be drawn.

The coefficient for the control variables are of the same sign as expected. Higher stock market capitalization to GDP leads to significantly lower levels of volatility in the stock prices of domestic banks. The relationship is robust at 1%-level in every specification expect when the KKZ – index is plotted. Higher volatility in GDP growth results in higher uncertainty in the stock market, though the coefficient does not enter significantly in every specification. Large currency depreciations in the previous year increase significantly the level of volatility in the stock prices of banks, but the effect of inflation is positive but insignificant. Better institutional quality decreases the volatility in the securities markets, though the relationship is not significant in every specification.

Table 14 shows that the coefficient of the *Entry Requirements* variable is insignificant in every specification, supporting the findings of Section 7, which indicate that tighter entry requirements do not have an effect on banking sector stability. The coefficient for the *Activity Restriction* variable is positive and significant in two specifications, but breaks down immediately when the macroeconomic factors are controlled for. This further supports my findings in Section 7, which show that tighter activity restrictions do not have a noticeable impact on banking sector vulnerability. The results of previous studies can thus be rejected with even greater certainty. Table 14 only reports the results when the weekly volatility is used as the dependent variable, but the results are similar when the monthly volatility is used. Based on the evidence presented, the first and the third hypotheses can be rejected.

9. Conclusion

Numerous systematic banking crises in the past two decades have alarmed national banking supervisors of the need to improve their bank regulations to better prevent the occurrence of these devastating episodes, which can obstruct the economic development of the whole country for many years to come. However, countries have adopted different approaches in enhancing their bank regulations. Some, for example, have erected more regulatory barriers

limiting foreign bank entrance and their ability to operate in the domestic markets, or have imposed stricter restrictions on permissible bank activities. Others, on the other hand, have relaxed their regulations, for example the repeal of the Glass-Steagall Act in the United States, believing that less stringent bank regulations will better foster the stability of the banking sector. There is not a consensus among national authorities, or academics, on what direction the bank regulations should be modified towards, and this is the area where this thesis attempts to add more to our knowledge.

The majority of previous studies done in this field have come to the conclusion that regulations limiting the ability of commercial banks to engage in different sorts of activities and regulations that impose excessive entry requirements for new banks create greater bank distress. My study, however, do not find evidence supporting these claims. The findings of this thesis show, that the significant relationships uncovered in other studies are mainly due to sample choice and is not robust when the regression specifications are modified. The year 1999 values of the *Activity Restriction* variables do have a considerable positive effect on the level of non-performing loans according to the regression models, but this relationship breaks down when the value of 2002 and 2006 are used. In addition, the coefficient is also insignificant when the sample period is divided and when countries that have realized significant changes in their regulatory environment are excluded from the sample. Furthermore, strict regulations limiting bank activities do not have an impact on the volatility of the stock prices of domestic banks either. All of these findings show that the results uncovered by previous studies are not robust and that there is not a positive effect between stringent activity restrictions and banking sector fragility.

The results of the regressions also show that the amounts of regulatory entry requirements do not have a significant impact on the level of non-performing loans. The coefficient of this regulatory variable is insignificant in almost every specification and these findings are also in contradiction with the findings of previous studies. The conclusion that could be drawn is that excessive entry requirements do hinder competition in the banking sector and do not create more corruptive actions from the authorities. However, there is not that great of a variation among countries in the amount of information that they require; many of the eight requirements used to build the variable are quite common in many countries. This might

partly explain the insignificant results. Therefore, it would be prudent not to draw any definitive conclusions based on these results.

After extensive empirical analysis, this study uncovers strong evidence that excessive regulations limiting the ability of foreign banks to enter and operate in the domestic market create higher levels of non-performing loans and thus more fragile banking sectors. What is quite interesting is that the impact of these regulations discriminating foreign banks is especially distinct for high income countries; the incremental effect of discriminatory regulations is more pronounced in a country with otherwise well-functioning institutions. My findings indicate that excessive entry and operational barriers for foreign banks limit competition in the banking sector, produce inefficiently functioning banks and hinders the adoption of modern banking skills and risk management procedures, all of which increases the probability of banking distress. The impact of discriminatory regulations remains robust when a host of macroeconomic and institutional factors are controlled for, when the sample period is divided into sub-samples and when countries that have experienced banking crises in the past or have implemented large changes in their regulatory framework are excluded. Furthermore, more barriers for foreign banks create more volatility in stock prices of domestic banks. However, this relationship disappears when the overall institutional quality of the country is controlled for.

A well-functioning banking sector is pivotal for economic development and growth. National regulations should be designed in a way in which they can foster the stability of the banking industry in the most efficient way. While the findings of this thesis do not show that regulations limiting bank activities or entry requirements have a significant impact on the vulnerability of domestic banks, it is not to say that these regulations are of irrelevance. Further studies are required to improve our knowledge on the ways and channels through which these regulations influences the banking sector. Future research should use more precise cross-country data on bank regulations and also different measures for bank fragility and distress. Furthermore, future studies should employ more sophisticated methods to examine the impact of regulatory changes on banking crises. For example, researches examining whether the repeal of the Glass-Steagall act influenced the occurrence of the recent credit crunch could be quite valuable. Last, investigating the effects of national bank regulations using bank-level data can truly add to our knowledge on this important subject.

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Appendix 1: Banking regulatory variables for individual countries

Country	Activity Restriction			Entry Requirements			Foreign Bank
	1999	2002	2006	1999	2002	2006	Discrimination
Argentina	7	11	11	6	7	7	0
Armenia	11	11	9	7	8	8	0.05
Australia	8	11	10	8	8	7	0.05
Austria	5	7	7	8	8	8	0
Bangladesh	12		13	6		6	
Belarus	13	12	10	8	6	8	
Belgium	9	9	7	8	8	8	0
Bolivia	12	13	13	8	8	8	0.033
Bosnia and Herzegovina	6	11	11	8	8	8	
Brazil	10	8	9	8	8	8	0.116
Bulgaria	10	9	10	8	8	8	0.05
Canada	7	7	8	8	8	8	0.116
Chile	11	13	14	3	4	4	0
China	14		15	6		8	
Colombia		13	14		8	8	0.133
Costa Rica		15	14		8	5	0.033
Croatia	7	8	8	7	7	7	0
Czech Republic	8	12	12	8	8	8	0.033
Denmark	8	10	9	8	8	8	0
Dominican Republic						8	
Ecuador		14			8		0
Egypt, Arab Rep.	13	10	10	6	8	8	0.083
Estonia	8	5	8	8	8	8	0
Finland	7	8	9	2	6	7	0.05
France	6	6	9	6	6	7	0.05
Gabon		8	11		8	8	0
Germany	5	7	7	4	7	6	0
Ghana	12	10	11	8	8	8	0.2
Greece	9	10	8	8	7	7	0
Hong Kong, China		6	5		6	6	0.05
Hungary	9	11	11	7	8	8	0.083
Iceland	11	9	10	7	8	8	0.05
India	10	12	11	6	6	6	0.466
Indonesia	14		16	7		8	
Ireland	8	7	7	7	8	8	0
Israel	13	13	12	6	3	3	0
Italy	10	10	12	8	8	8	0
Japan	13	11	11	6	7	7	0.05
Jordan	11	9	11	8	7	8	0.05
Kenya	10	9	13	8	7	8	0.2
Korea, Rep.	9	12	11	7	8	6	0.05
Kuwait	10	7	10	5	6	8	0.383
Latvia	8	7	8	6	8	8	0.05
Lebanon	11	10	11	8	8	8	
Lithuania	9	8	11	8	8	8	0.05
Luxembourg	6	6	9	8	8	8	0
Malaysia	10	11	11	7	7	8	0.266
Mexico	12	10	5	8	8	8	0.216
Morocco	13	10	12	8	8	8	0.15
Mozambique						8	
Netherlands	6	6	6	8	8	7	0
Nigeria	9	12	11	8	8	8	0
Norway		7	11		8	8	0.05
Oman	13	12	11	8	8	8	0.05
Pakistan		12	13		7	7	0.433
Panama	8	11	11	8	8	8	0

Paraguay		12			7		0
Peru	8	7	12	8	7	6	0
Philippines	7	7	7	7	8	8	0.35
Poland	10	7	8	7	7	8	0.05
Portugal	9	10	12	7	7	7	0
Russian Federation	8	8	8	8	7	8	
Saudi Arabia	11	11	12	8	8	8	0
Senegal		10	11		8	8	0.233
Singapore	8	10	10	7	8	8	0.083
Slovak Republic	9	11	10	8	8	8	0.033
Slovenia	9	11	10	8	7	8	0
South Africa	8	8	10	8	6	8	0.05
Spain	7	6	7	8	8	7	0
Sweden	9	8	10	8	8	6	0
Switzerland	5	7	8	8	8	8	0.05
Thailand	9	12	13	8	8	8	0.283
Turkey	12	8		7	7		0.05
Uganda			12			8	
Ukraine		7			8		
United Arab Emirates		8			8		0.216
United Kingdom	5	5	4	8	8	8	0
United States	12	11	11	7	8	8	0.1
Uruguay		10	12		7	7	0
Venezuela, RB	10	9		8	8	7	0.05